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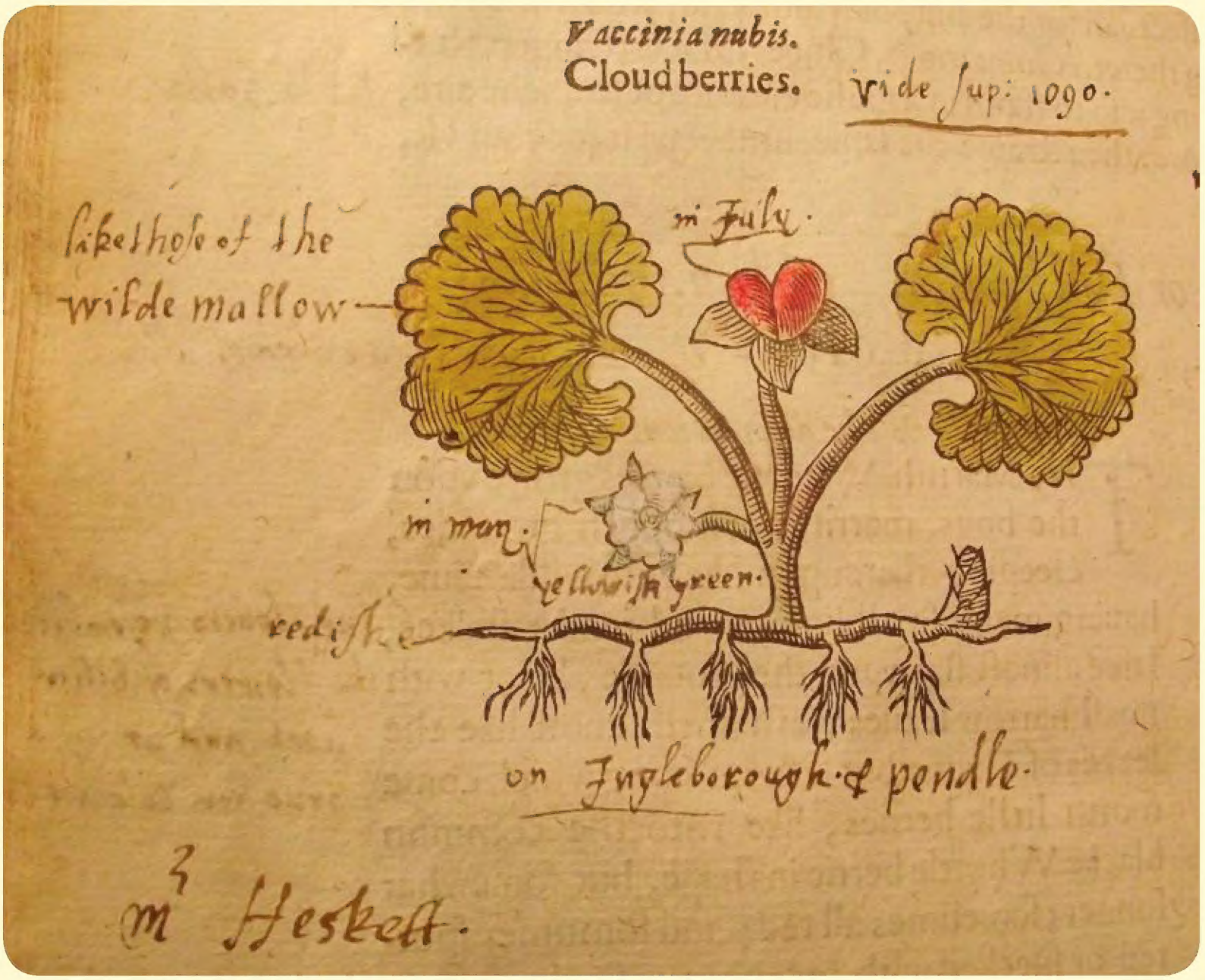

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Contents

An asterisk* indicates a peer-reviewed paper

Front cover: A sample page from the Folger Library copy of Gerard's Herball, hand-coloured and with annotations (see p120). Reproduced with permission of the Folger Library, Washington, D.C.

Back cover: YNU President Jane Pottas with a piece of Sugar Kelp at a Marine & Coastal Section field meeting to Boggle Hole. Photo: *Paula Lightfoot*

The Naturalist

The last of the Yorkshire Wildcats

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On 14 June 2019, at Tennants Taxidermy Auction, Leyburn, North Yorkshire, Lot 2102 was advertised as the head of a Wildcat *Felis silvestris*, mounted as a trophy on an oak shield (Figure 1). It had been preserved and mounted by the celebrated firm of Henry Murray & Son, 'Naturalist and Specialist in Pictorial Taxidermy', Bank Buildings, Carnforth, Lancashire. A fine example of their illustrated paper trade label, a collector's item in its own right, is pasted on the back (verso) of the shield. An 'Ivorine' label, on the front of the shield below the cat's throat, gave the acquisition date as 27 December 1926 and its provenance as Cracoe (near Skipton). Although Tennants' catalogue estimated its auction value as between £300 and £400, the specimen generated sufficient interest to exceed this, selling for £700.

Figure 1. Facial view of Lot 2102, the Cracoe 'Wildcat' specimen preserved and mounted by Henry Murray & Son, Carnforth, and dated 27 Dec. 1926. *Michael Jackson*

The specimen was indeed of considerable interest, being of a species currently on the brink of extinction in the United Kingdom. Once widespread in Britain, with many historical Yorkshire records, its current distribution confined to the remotest parts of the Scottish highlands is the result of centuries of persecution and habitat loss/fragmentation. Whereas persecution remains a problem, the genetic purity of the last survivors is becoming compromised by hybridisation with feral domestic cats *Felis catus*. Ironically, this latter factor also serves to undermine the implementation of protective legislation under Schedule 5 (animals which are protected in England, Scotland and Wales) and Schedule 6 (animals which may not be killed or taken by certain methods) of the Wildlife and Countryside Act, also Annex IV of European Directive 92/43/EEC (the Habitats and Species Directive).

Kitchener and Daniels (2008), in comparing the pelts of Wildcats, of similarly patterned striped tabbies and of hybrid wild/feral striped tabbies, have now demonstrated a number of pelage characteristics unique to true Wildcats. Relevant to the Cracoe mounted head, a key Wildcat pelage feature is the pattern of four thick black longitudinal stripes on the nape of the neck (see Figure 2 p84), those on feral tabbies or hybrid animals being thin or absent. Other discriminating elements associated with structures in the skull and jaw (see Kitchener & Daniels, *loc.cit*.) may have been discernible via x-ray examination but the opportunity to undertake this investigation never became available.

The past status and distribution of Wildcats in Yorkshire, based on archaeological evidence (Mesolithic to Roman), place names (1086 [Domesday] to 19th century), hunting licences (12th to 17th centuries), parish bounty payments (16th to 19th centuries) and topographical/natural history records (18th and 19th century) is collated and reviewed in Howes (1984, 2002 and 2009).

Of 29 Yorkshire place names judged by etymologists to allude to Wildcat, all are exclusively distributed along the Pennines or Pennine foothills, mainly at altitudes above 400ft. Similarly the nine parishes where bounties were paid for Wildcats, Slaidburn (SD7152), Shipley (SE1537), Ilkley (SE1147), Ecclesfield (SK3593) and Harthill (SK4980) are distributed along or adjacent to the Pennine uplands and Masham (SE2280), Wadworth (SK5696), Whiston (SK4590) and Thorpe Salvin (SK5281) along or adjacent to the Magnesian Limestone Permian ridge south to the South Yorkshire-Nottinghamshire border (see Howes, 2002 & 2009).

In order to show the parishes paying bounties for Wildcat in a national context, data in Howes (2009) and Lovegrove (2007) are amalgamated in Figure 3, showing a 10 x 10 km distribution and ranked frequency map of Wildcat in parishes across England and Wales. This shows a generally sparse but marked westerly distribution with concentrations in Cornwall, Wales, Cumbria, and in the context of Yorkshire, along the Pennine uplands and the Permian ridge. This echoes the distribution of the preferred habitat of upland woodland, the borders of forest and open hilly ground where Wildcats hold territories of 60-70ha (Kolb, 1977) and gives a rationale for their scarcity or absence from the managed arable landscapes of the lowland eastern counties.

It is difficult to plot precisely the Wildcat's decline in Yorkshire. During 1550-1599 Wildcats constituted 3% of carnivore bounties; this level fell to 0.3% in 1600-1649, 1% in 1650-1699 and 1% in 1700-1749, falling to 0.1% in 1750-1799 and was unrepresented during the 19th century (Howes, 2009). This trend is confirmed by Lovegrove (*loc. cit*.) who traced 670 Wildcat bounties from parishes across England and Wales for the 17th century, 322 from 1701-1750, 109 for

1751-1800, and only 4 for the 19th century.

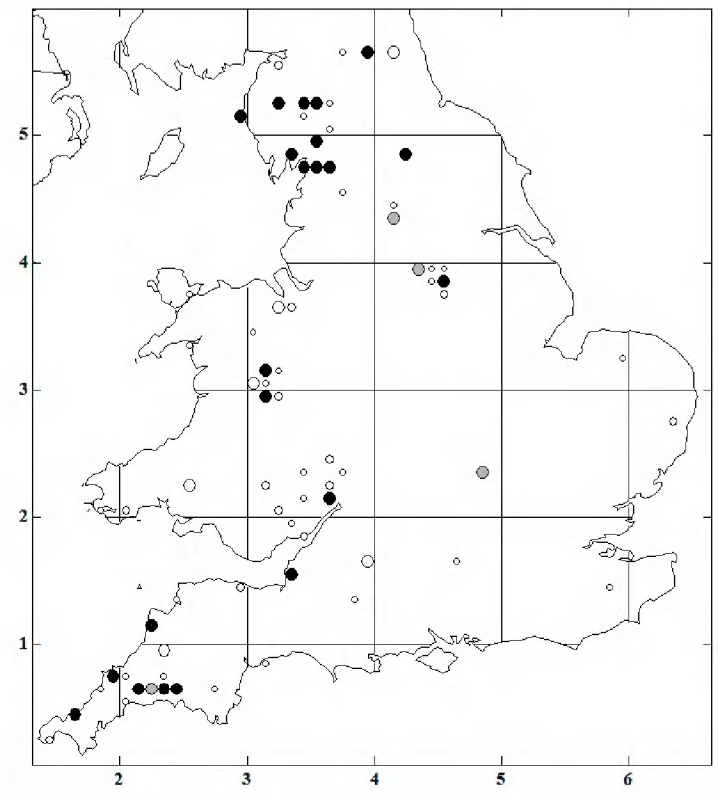

Figure 3. 10 km distribution and relative frequency of Wildcat bounty payments in English and Welsh Parishes from the late 16th to early 19th centuries, based on data from Lovegrove (2007), Howes (1984, 2002, 2009).

Symbols relate to Lovegrove's (2007) relative frequency codes: 5 (many) = ● reducing to 1 (few) = ◦

With regard to frequency relative to other targeted carnivores, bounty payments for Wildcat have only been located in the accounts of 9 (8.8%) Yorkshire parishes out of 102 for which bounty payments were made. This indicates their scarcity relative to Polecat *Mustela putorius* 73 (71.5%), Fox *Vulpes vulpes* 68 (66.6%), Badger *Meles meles* 27 (26.4%), Otter *Lutra lutra* 20 (19.6%) and Weasel *Mustela nivalis* 16 (15.6%). Only Pine Marten *Martes martes*, in 4 parishes (3.9%), was scarcer.

Although plausibly argued by Langley and Yalden (1977) that the demise of the Wildcat and the other rare carnivores in England came about by intensification of persecution through the 19th century boom in game-keeping, it would seem likely from evidence presented here that in Yorkshire, at least, it had been largely absent from eastern and lowland regions since the 14th century. Its decline and ultimate eradication in the Pennine and Permian ridges took much longer, with viable populations surviving to the late 18th century.

That Wildcats may have survived in Yorkshire into the 19th century is indicated by unsupported anecdotal records of one at Northowram (SE1127) in 1830 (Johnson 1965), and one trapped by John Harrison one winter around 1840 on his farm at Murton (SE5388) near Hawnby in the North York Moors (Clarke & Roebuck, 1881; Fortune, 1916). However, Barker (1854) alluded to Wildcats being 'still occasionally found in the woods of Wensleydale', thereby post-dating the 1840 Murton record. Clarke and Roebuck (*loc. cit.*) conceded that 'in all probability Wildcats once existed in the fells of the north-west'. If a residual population had persisted after this time, records of Wildcats would surely have featured, as did those of other large carnivores, in the regional natural history journals which proliferated during the mid-to late 19th century.

A summary of claimed Wildcat records in Yorkshire from 1550 to 1949 is given in Table 1 below.

Figure 2. Dorsal aspect of the 'Wildcat' head, showing the four broad black bands.
Michael Jackson

Table 1. Localities, numbers, dates and date ranges for claimed Wildcat records in Yorkshire parishes. Numbers of records in round brackets. Dates in square brackets indicate the range of the archive, exact date of Wildcat record not known. (Based on Howes (2002), Lovegrove (2007) and this study).

50 year date range	**1550-99**	**1600-49**	**1650-99**	**1700-49**	**1750-99**	**1800-49**	**1850-99**	**1900-49**
Ecclesfield (2)	1589	1626						
Masham (25)			1652-76					
Shipley (4)			1676-80					
Thorpe Salvin (36)			1699	1700-37	1769			
Whiston (1)				1710				
Harthill (1)					1773			
Ilkley (?)		[1623		1703]				
Slaidburn (?)					[1753	1831]		
Northowram (1)						1830		
Murton (1)						1840		
Cracoe (1)								1926

Cracoe (SD9759) in the Craven Pennines of the Yorkshire Dales is comfortably within the Pennine place name and parish bounty payment zone (see Howes, 2002 & 2009) and fits within the Dales region alluded to by Barker (*loc. cit.*) and Clarke and Roebuck (*loc. cit.*). However for

this specimen to date from as late as 1926 seems most improbable for it to represent a true *F. silvestris.* It is tantalising therefore to note the four broad black nape bands (see Figure 2), characteristic of *F. silvestris* but disappointing (through being out-bid at the auction!) not to have been able to further investigate its skull characteristics to confirm the identity either way.

Acknowledgements
Thanks are due to Michael Jackson for drawing my attention to the Cracoe specimen at the Tennants Taxidermy Auction and for taking the photographs.

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YNU notice

New YNU Treasurer

Guy Baragwanath has taken over from Barry Warrington as Treasurer for the YNU. He is a partner in the accountancy firm C&GB Associates and has had a lot of experience working with charities, including the Lower Ure Conservation Trust. Guy can be contacted via the usual Treasurer's email address: treasurer@ynu.org.uk.

A detailed study of the ecology and hydrology of Fen Carr nature reserve

Jim Horsfall, Yorkshire Wildlife Trust
email: Jim.horsfall@ywt.org.uk

Introduction

Fen Carr nature reserve (Figure 6, p92) is a lowland meadow in Doncaster district. It has a strong hydrological influence and is considered a floodplain meadow (MG4 on the National Vegetation Classification, NVC) (Rodwell, 1992). This hydrological influence is despite the fact that the nearby river Don was straightened and embanked decades ago. The hydrology is a major factor that determines the botanical interest of the site (along with the historic management as a hay meadow). Research into the botany, soils and hydrology of the site were undertaken over two and a half years to help to explain the particular characteristics of the site. The data collected could also be useful to show that surrounding fields could potentially be good MG4 sites which need maintaining, improving or even recreating.

The site is a Yorkshire Wildlife Trust (YWT) nature reserve, prior to which it was Church glebe land, which may be why it has survived with no agricultural 'improvement'. It is north of the village of Fishlake; there is no Public Right of Way but there is an open gate policy whereby anyone is welcome to look round (if care is taken not to spoil the hay crop that may be growing). Access is via a kissing gate at SE65751549.

This study was undertaken for Yorkshire Wildlife Trust and the Floodplain Meadows Partnership, and a full report is available from the author.

Methods

A look at historic records for the site (primarily *ad hoc* species records and old NVC maps and reports) complemented newly-gathered data. A dipwell was installed to measure the depth of the water table and recorded around once per month. A new NVC survey was undertaken and mapped to compare to previous records. A soil core was taken with a 5cm auger to look at the soil profile to see the potential impact of water movement through the soil (as the site no longer floods due to embankment of the river). A soil sample was sent for basic analysis to see if there were any issues arising from this.

Historic management was also considered as an important factor in what vegetation is present, and whether this vegetation type would continue to be present into the future.

Results

Soil profile

The soil core taken (Figure 1) was very much in agreement with what the Floodplain Meadows Partnership say is typical or ideal for a MG4 type of wet meadow (Rothero *et al*, 2016). It shows a good layer of dark coloured top soil followed by a thick layer of clay (with sand and silt) above a layer of sand (in other parts of the country it is gravel). This sand allows water to flow through the soil sideways and allows the river to still influence the site through a high water table. So, although river flooding no longer occurs, the stresses caused to the plants from waterlogged

soil are similar, meaning that plants typical of floodplain meadows persist.

Dipwell and water table

The conclusion from examination of the soil profile is that the site is still able to be influenced by high levels in the river from transverse flows through the sand layer in the soil. Records from the dipwell show that this assumption is correct. The dipwell was only 1m deep (if the water table is more than 1m below the surface it will have no effect on even deep rooted plants, except a drought stress). Figure 2 shows the readings (taken roughly monthly) against an idealised maximum and minimum for MG4 grasslands (Wheeler *et al*, 2004). The water table is slightly above the ideal at times, but mostly is within the boundaries.

The periods of higher water table tend to be in the winter, when the plants are not growing, so the effect on the botany of the site is less (many plants can tolerate minor flooding when they are not growing). But for several weeks a year the water table is below the point that the soils would be completely waterlogged, but still high enough for the water to be influencing the soil/ roots. These stresses mean that a distinct wet meadow flora has developed and is maintained. In other floodplain meadows the community is quite dynamic. A severe flood once every few years means a shift to more waterlogging-tolerant plants that can take several years to revert back to a slightly drier flora. However, as this site does not flood from the river this dynamism is presumed to have been lost and a fairly constant community is likely to have arisen. However there are insufficient data to show this at present.

Flora

The site is a good example of an MG4 meadow, although due to its small size (4.3ha) it does not hold all the plants associated with large floodplain meadows (such as the Lower Derwent Valley and Cricklade meadows). It has Glaucous Sedge *Carex flacca,* Carnation Sedge *C. panicea*, Pepper Saxifrage *Silaum silaus*, Greater Bird's-foot-trefoil *Lotus uliginosus*, Meadowsweet *Filipendula ulmaria* and Meadow Vetchling *Lathyrus pratensis*, as well as the constant ones for MG4 of Great Burnet *Sanguisorba officinalis* and Meadow Foxtail *Alopecurus pratensis*.

The site's flora was studied in depth using standard NVC methods, and the communities mapped. Luckily there are two previous NVC maps for the site so we can compare them over time. The first map (Figure 3) is from 1996 and shows a fairly uniform community, although it is uncertain whether this results from lack of detailed mapping or from a reality of a uniform sward. The site has ridge and furrow landform, so the deeper furrows will always have had a wetter community, but these could feasibly have sat in the MG4 category (it is only recently that further studies in MG4 have resulted in 4 sub-communities, based on a matrix of wetness and fertility) (Floodplain Meadows Partnership, 2014). An area now classified as a swamp community was already wetter than the rest of the site in 1996. A further NVC map (Figure 4) was drawn from surveys in 2002 showing slightly more diversity of community. Other wet areas picked up in the most recent NVC map were drawn on, although the main area of fields is marked as a single colour, with 4 NVC types shown as present within it. Is this a more accurate map, or has the site got wetter? As it indicates wetter communities amongst the MG4, both are possible. As I have only known the site since 2012 I am not able to say from my own experience.

The plants associated with the wetter areas include Reed Canary Grass *Phalaris arundinacea* and Reed Sweet-grass *Glyceria maxima* for the swamp area, and Cuckoo Flower *Cardamine*

pratensis and Soft Rush *Juncus effusus* for the rush pasture. These must have been present on site throughout, as the surrounding fields are 'improved'.

Depth below surface	Description	Photo (uppermost part to left)
0-20cm	Top soil, humus rich	
20-75cm	Silty clay traces of sand, mostly grey in colour	
75-100cm	Sandy clay, mostly orange in colour	
100cm+	Grey sand with small amount of clay and silt	

Figure 1. Fen Carr soil profile showing four different horizons.

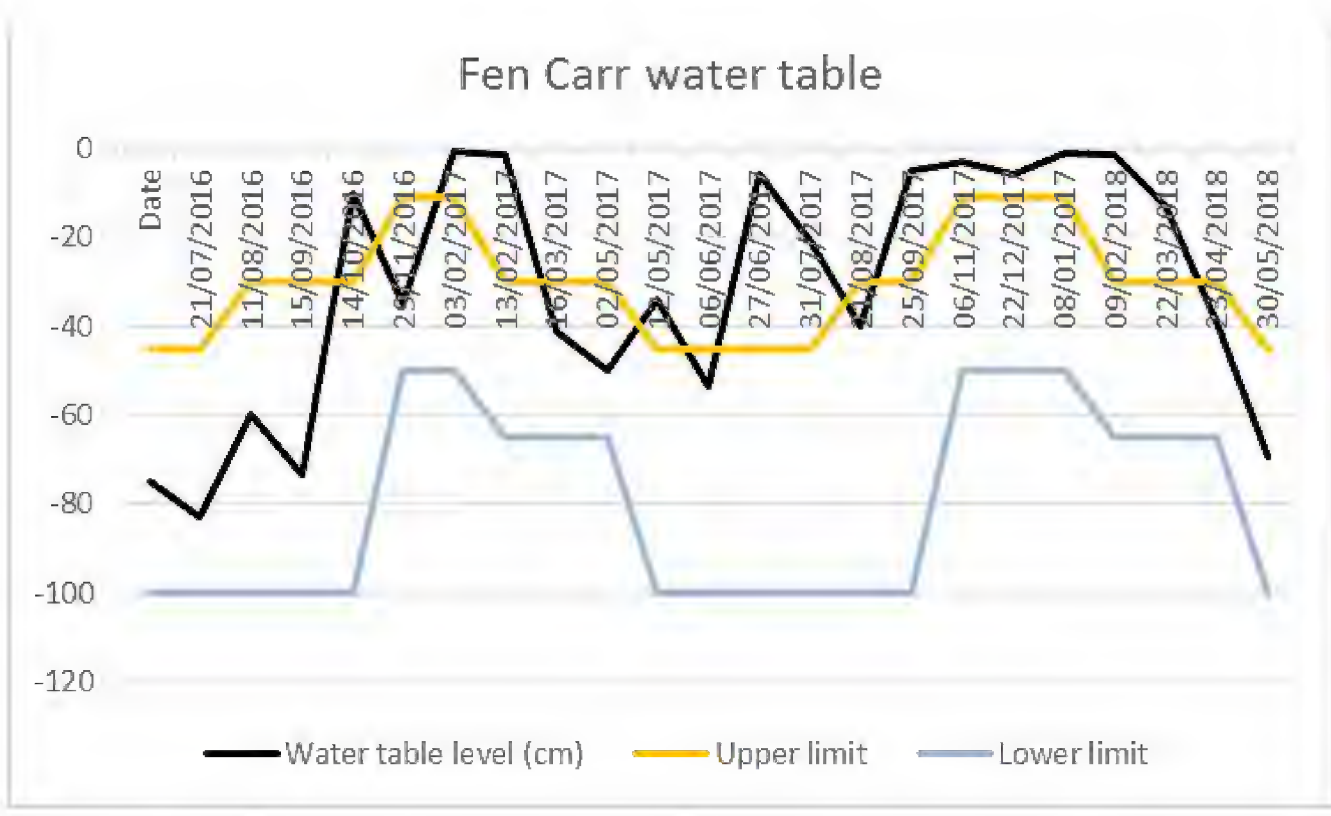

Figure 2. Fen Carr water table data from the dipwell plotted against an idealised range for MG4 grassland.

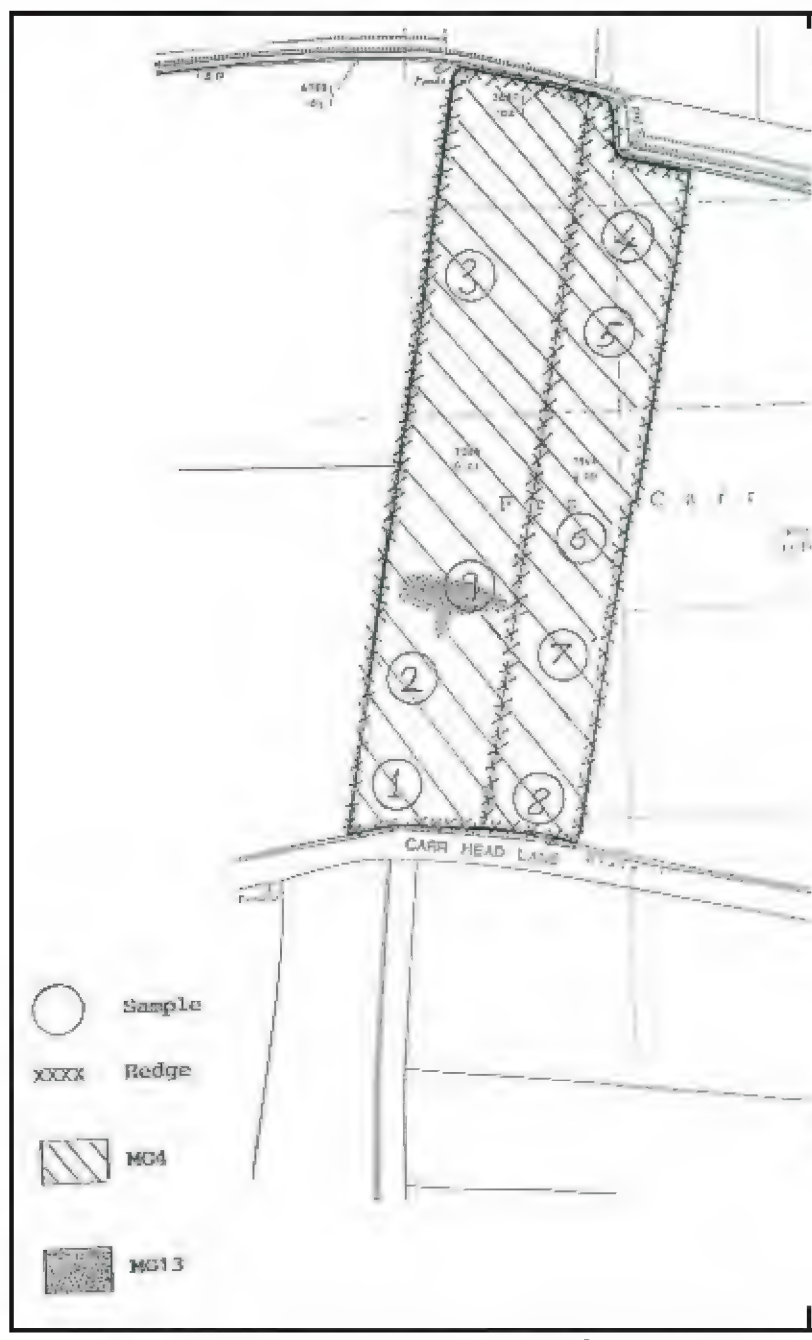

Figure 3. NVC community map from 1996

Figure 4. NVC community map from 2002

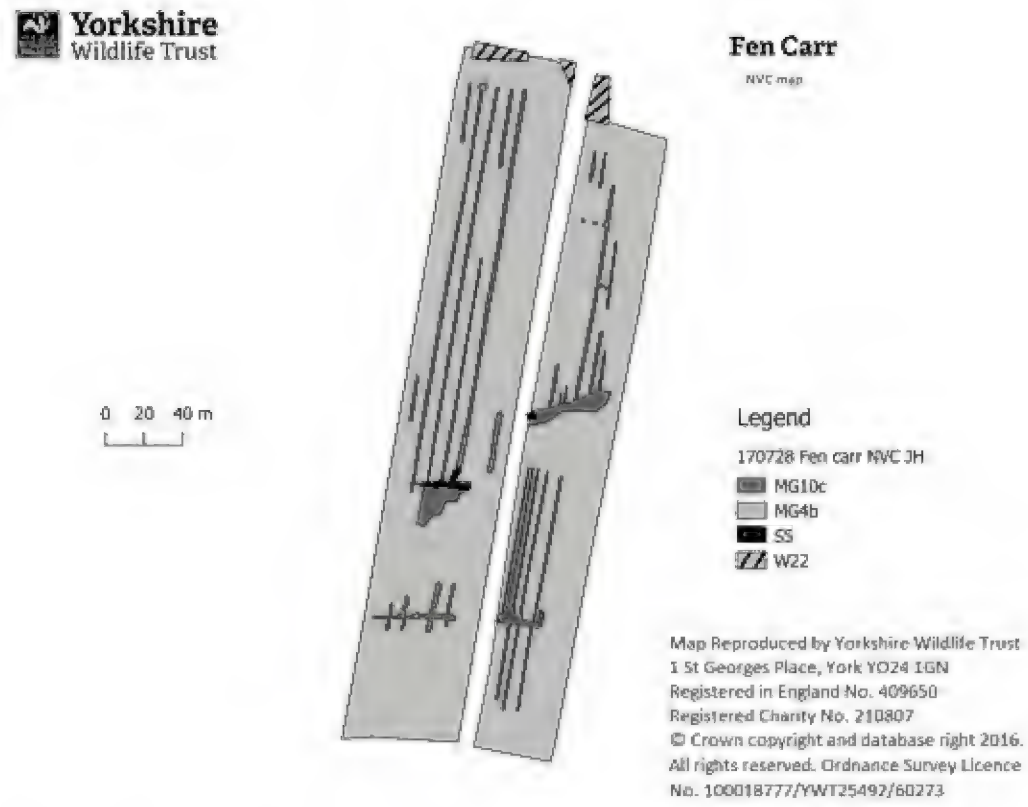

Figure 5. NVC community map from 2017

The 2017 NVC survey and map (Figure 5) show in much more detail the distribution of communities. Although since the 2002 survey the NVC communities have been clarified so whereas before it may have seemed not to have fitted MG4 entirely, it can now be placed in MG4b. The areas of rush pasture (MG10c) and swamp (S5) are still present, but their distribution in the furrows and lowest dips is shown in detail. This is possibly due to the increasing use of GIS and aerial photos, which make delineating the boundaries between communities much easier (if the colour of the vegetation differs).

Soil chemistry

The soil sample taken was analysed by a lab at the Open University and showed a pH of 5.24, which is more acidic than is typical of a floodplain meadow (more usually >5.5). The phosphorus was also measured (as this is usually the main limiting factor in flora diversity - too high and grasses become dominant). The results showed an Olsen index of 9.5 which is well within the limits of 'normal' for this kind of site (Rothero *et al*, 2016).

The acidity of the site could be due to the combination of soil waterlogging and lack of flooding from the river. This may seem like a contradictory statement but waterlogging can cause chemical change reducing pH whereas flooding from the river would bring base rich sediments that would raise the pH (Rothero *et al*, 2016, p35).

Historic management

The site was acquired by Yorkshire Wildlife Trust in the 1990s at the same time as two other MG4 grasslands in Doncaster district (Owston Old Glebe, now part of a larger Owston Meadows site, and Hopyard Haymeadow). It is presumed that the continued traditional management of these three sites was due to ownership by the Church of England, when the vast majority of the surrounding land was turned over to arable or 'improved' with fertiliser and/or rye grass seeding. Since Yorkshire Wildlife Trust has managed Fen Carr the site has continued to be cut for hay in July and grazed in autumn or winter.

In two of the seven years I have known the site it has suffered illegal fly grazing by ponies (not uncommon on many fields around Doncaster, and much more common than many other parts of Yorkshire). This was after the local tenant (who had tenanted the field since before the ownership change from the Church to YWT) gave up managing the site, so a very local eye on the site was lost, giving more opportunity for fly grazers.

Discussion

This site is a good quality lowland wet meadow, predominantly of MG4b type. It is in good management and should persist in a good state for some time to come. It is not possible to know with certainty if the site is changing significantly (perhaps getting wetter or more acidic). The NVC maps and other information could be showing one of two things, the site is getting wetter (and hence the areas are more easily mapped) or the accuracy of mapping has got better. Both are possible and so is the possibility that both are occurring. The drains running along the length of the site have not been cleared for decades, and are gradually being infilled. GIS and aerial photos are now more accurate and pin-point to within a metre the boundaries of one vegetation type and another.

This being said, MG4 and its associate vegetation communities are highly dynamic, so a run of wet or dry years could indeed change the extent of communities. Another possible factor creating a real change (rather than a change in detail of mapping) could be increasing acidity. There is no historic soil chemistry data to compare to, but personal communications with Prof. Gowing at the Floodplain Meadows Partnership highlighted this as a potential cause of a change (Gowing, pers. comm.). He also highlighted that MG10 rush pasture is often associated with compaction, so leading hay off the site at times of soil waterlogging could be another contributing factor.

Unfortunately, more historic data do not exist but the data presented here are a start, a new baseline to work from. There are however two other Yorkshire Wildlife Trust MG4 sites in Doncaster district and at least one further site in private ownership. Highly dynamic communities like MG4 (floodplain meadow), MG8 (kingcup-carnation sedge meadow), MG13 (foxtail plash) or MG14 (sedge lawn) can change for any one of a number of reasons, so having baseline information can help to narrow down possibilities and prevent species decline or loss.

Conclusions and recommendations

As much information about these sites should be gathered as possible. The Wildlife Trust has limited resources and welcomes data from other sources. This allows a better understanding of the site in question, and helps to create a reference against which other sites can be compared. The Floodplain Meadows Partnership has been working towards this end for some time and is continuing to do so (as long as funding can be secured). Ideally data should be shared with the Floodplain Meadows Partnership to allow a fuller picture of the UK's floodplain meadow resource. According to a recent inventory of sites (http://www.floodplainmeadows.org.uk/about-meadow/conservation), there are only 1171ha of MG4 grassland remaining in the UK, so even small sites are significant and valuable.

Figure 6. Fen Carr Nature Reserve. *J. Horsfall*

If you know of a site like this and want to learn more about it a very helpful Floodplain Meadows handbook is available from www.floodplainmeadows.org.uk. It gives details of the methods used here to assess a site. Alternatively please contact myself or a member of the Floodplain Meadows Partnership team for help or advice.

Finally, more wet meadows should ideally be recreated near to extant meadows to create larger islands of biodiversity in the 'improved' deserts of modern farms. We cannot turn the clock back but we can help to preserve what we still have. The Burnet Trust and Yorkshire Wildlife Trust work in the area around Fen Carr exactly to this purpose, as do others further afield, but it requires time and money. Although Fen Carr is secure, who knows what the future holds for other sites?

Acknowledgements

Thanks to the staff and volunteers of Yorkshire Wildlife Trust who gave assistance in gathering data, and the Floodplain Meadows Partnership which has helped in giving training on methods and interpreting of data.

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When conserving one moth conserves another: The distribution of the Small Chocolate-tip moth on Creeping Willow at Strensall Common

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Introduction

Much research has suggested that competition between insect herbivores is often insignificant because such herbivores are subject to density-dependent population regulation, for example from natural enemies, which limits their numbers (Strong *et al.*, 1984). Despite this, individual pairs of herbivores may still affect each other's fitness negatively, either directly or indirectly (e.g. Müller & Godfray, 1997). This may sometimes be important in the conservation of rare insect herbivores, where one herbivore might make conditions less suitable for another subject to conservation measures (e.g. MacGregor *et al.,* 2017). In this paper we report the incidence of a nationally scarce moth (Small Chocolate-tip *Clostera pygra*) on a host-plant (Creeping Willow *Salix repens*) which is subject to conservation measures in order to promote a conservation-priority moth (Dark Bordered Beauty *Epione vespertaria*). We suggest that conservation measures protecting the host plant for the Dark Bordered Beauty may incidentally be benefitting Small Chocolate-tip, but that the Small Chocolate-tip moth (Figure 1 below) might also negatively affect Creeping Willow.

Figure 1. Adult Small Chocolate-tip moth *Clostera pygra*.
M. Parsons/Butterfly Conservation

The Dark Bordered Beauty moth is of principal importance for the conservation of biodiversity in England under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 and is listed as 'Rare' in the UK Red Data Book (Shirt, 1987). In England it is currently confined to Strensall Common, near York, where a monitoring transect has documented strong declines in the population since 2009, thought to have been partially caused by overgrazing

of the larval food-plant, Creeping Willow, by sheep (Baker *et al.*, 2016). In 2015, and the two subsequent years, several small plots of metal fencing (termed grazing exclosures below) designed to exclude vertebrate grazers (especially sheep) were established on Strensall Common in areas where Dark Bordered Beauty was currently or previously known to be present (Wainwright, 2016). Some of these plots contained existing Creeping Willow plants and in others pot-grown plants grown from local seed were planted. Since 2015, these and some control plants have been monitored annually alongside adult Dark Bordered Beauty numbers. In 2017, casual observation indicated severe defoliation of some Creeping Willow plants inside grazing exclosures by insects, and in response to this, in 2018, counts were made of any insect herbivores, or associated structures, seen when monitoring Creeping Willows.

One of these insect herbivores is the Small Chocolate-tip moth (Lepidoptera: Notodontidae). This moth is classified as Nationally Scarce B (recorded from 31-100 10km squares in Britain since 1980) and is restricted to a small number of widely scattered regions across the UK (Waring & Townsend, 2017). Although they can be attracted to light (South, 1961), adult moths use wetland habitats (Heath & Emmett, 1979) that can be less commonly surveyed by light traps for practical reasons, such as fens, marshes and wet heaths. Adults are also sometimes seen by day, but generally the number of adult records is quite low (South, 1961); for example, between 1883 and 2017 only 12/29 records in the Yorkshire moth database were of adults, a relatively small fraction for a macro-moth, and a very small total number considering that it has probably been continuously present at some sites over many years (Sutton & Beaumont, 1989). Small Chocolate-tip, however, is more easily surveyed in the larval stage (South, 1961), although this requires more specialized knowledge and is quite rarely performed. The larval food-plants include small shrub willows such as Creeping Willow *Salix repens*, and the solitary larvae create a distinctive tent "spinning" by binding together two or more leaves (Heath & Emmett, 1979), often near a shoot tip, with silk (Figure 3 p96). If desired, the spinning can be gently teased apart to locate the caterpillar inside, but caterpillars can sometimes be seen by day feeding outside their spinnings (Figure 4 p96). The presence of spinnings on Creeping Willows makes the moth distribution relatively easy to survey in its larval stage at known sites.

Below we report the 2018 distribution of Small Chocolate-tip larvae and spinnings on Creeping Willows at Strensall Common surveyed for the conservation of Dark Bordered Beauty, and discuss the implications for the conservation of both moths.

Methods

Creeping Willow patches inside and outside a series of small grazing exclosures were surveyed between 26th June and 13th July 2018 (Table 1 p97). In each exclosure every patch was surveyed, whilst up to ten patches were also surveyed outside each exclosure, normally within one exclosure's diameter of the exclosure where available, and closer to the focal exclosure than any other. Since Creeping Willow displays subterranean rhizomatous vegetative growth, it is difficult to identify stems belonging to the same plant, so we followed Robertson (2005) and Baker *et al.* (2016) in defining two stems as belonging to the same 'patch' when they were within 30cm of each other. Several morphological measurements were made of each patch (Table 2, p97), including a score of leaf hairiness, because leaf hairs (trichomes) can sometimes impede herbivore growth (e.g. Tian *et al.,* 2012). In addition, the number of leaf spinnings of Small Chocolate-tip larvae, and any other herbivorous insects (including Small Chocolate-tip

larvae themselves when visible outside their spinnings) were recorded. The presence of leaf spinnings was also noted at other locations where Creeping Willow was seen during the course of the study period.

To reduce the variation in Creeping Willow patch characteristics to a small number of orthogonal variables, a Principal Component Analysis (PCA) was carried out on the patch characteristics, all $\log_{10}$ transformed prior to analysis because frequency histograms showed evidence of being skewed to the right (having a long tail in the positive direction), which was often substantial. Prior to this analysis, the potential collinearity between different patch variables was investigated by pairwise Pearson's correlations, and where two (logged) variables explained >50% of the variance in each other, indicating that they were effective proxies for each other, one variable was deleted from the PCA dataset. The remaining variables were then also standardized. The extracted components were used as explanatory variables of further analyses investigating the effects of plant morphology. A general linear model was constructed of the number of Small Chocolate-tip larval spinnings per Creeping Willow patch using the *glm* function in *R*. Because the response variable was in the form of counts, we specified a log link, and a Poisson error structure. Explanatory variables included the grazing exclosure plot (fixed factor), whether the patch was inside or outside the plot (fixed factor), and the first two Principal Components of patch morphology. To compare alternative models with different combinations of main effects, exploratory multi-model inference (Burnham & Anderson, 2002) was carried out using the function 'dredge' in the *R* package 'MuMIn'. This highlighted a single best model, which showed overdispersion, so comparison of the best four models was repeated using a quasi-Poisson error structure and Quasi-AICc scores to account for this. Any models within five QAICc units of the best model are reported.

Results

We surveyed 451 patches of Creeping Willow in or around the 26 grazing exclosures in 2018. Of these, 156 (35%) contained one or more leaf-spinning of Small Chocolate-tip larvae, making them by far the commonest insect herbivore seen in the survey (the next most abundant was the Willow Berry Gall caused by the sawfly *Pontania collactanea*, seen on only 30 patches). The total number of spinnings counted was 1025, and the frequency per patch was significantly more aggregated than expected from a random (Poisson) allocation to patches (χ^2 = 1537, d.f.=6, P < 0.001) (Figure 2 p96). Spinnings were found at every plot surveyed and in addition to these spinnings, we observed 29 larvae outside spinnings on 23 different patches (Table 1).

Of the different plant variables measured (Table 2 p97), most were significantly correlated with each other, which is unsurprising given the large sample size (Table 3 p98). Only two however explained >50% of the variance in each other. Maximum height and mean height were, unsurprisingly, good proxies for each other, and maximum width and number of stems were also good proxies for each, other, again unsurprisingly (Table 3 p98). Mean height and number of stems were therefore deleted from the subsequent PCA, therefore retaining maximum height, maximum width, mean leaf length, mean leaf density and leaf hair density.

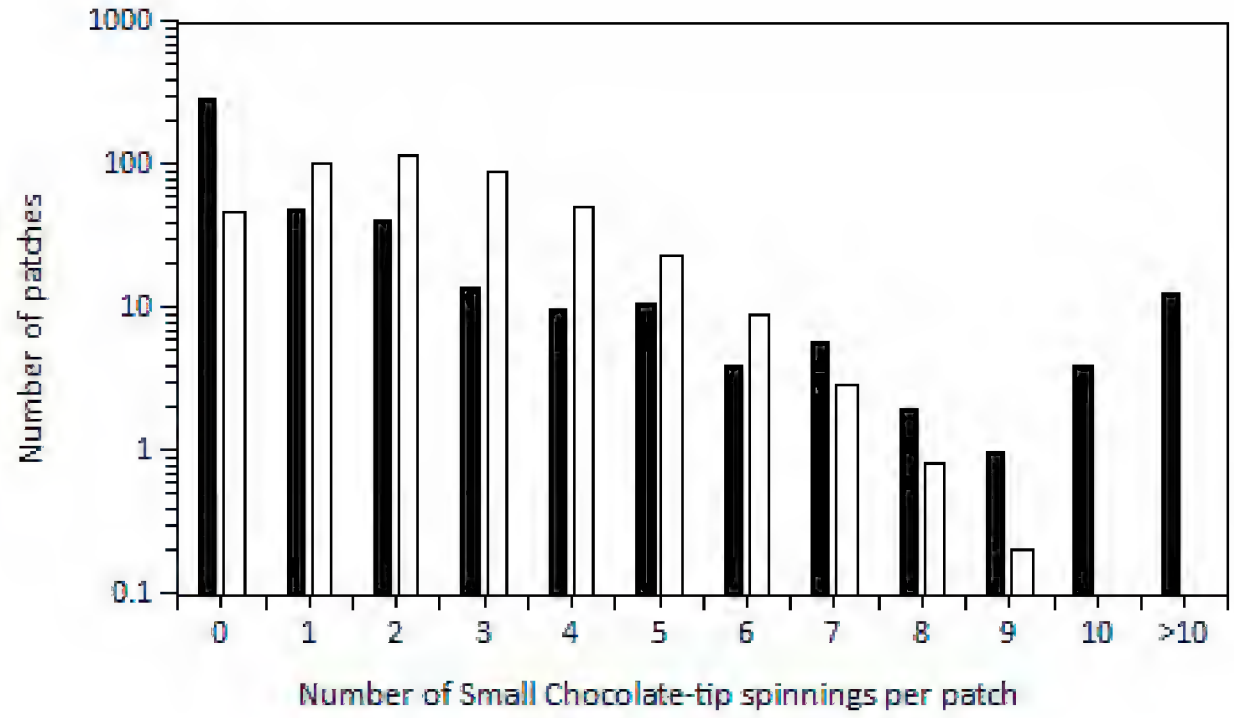

Figure 2 (see p95). Frequency distribution (log scale) of Small Chocolate-tip larval leaf spinnings per Creeping Willow patch (black bars), compared to the expectations of a random (Poisson) allocation across patches (white bars).

Figure 3 (see p94). Larval leaf spinning of the Small Chocolate-tip moth on Creeping Willow. The leaves of this plant are not visibly hairy. *P. Mayhew*

Figure 4 (see p94). Larva of Small Chocolate-tip moth on Creeping Willow. The leaves of this plant are visibly hairy. P. Mayhew

Table 1 (see p94): Grazing exclosures (plots) surveyed (both inside and immediately outside) for Creeping Willow in 2018, and the presence and abundance of Small Chocolate-tip spinnings and larvae (outside spinnings). A Gengard unit is a 2.4m length of metal grid fencing.

Plot number (year established)	Plot length and width (Gengards)	Grid reference	Date surveyed	Patches with spinnings/ patches surveyed	Total spinnings	Total larvae
1 (2015)	1x1	SE 6526 6097	2nd July 2018	4/12	56	2
2 (2015)	1x1	SE 6526 6098	2nd July 2018	4/14	10	3
3 (2015)	1x1	SE 6526 6098	2nd July 2018	4/12	12	1
4 (2015)	1x1	SE 6527 6097	2nd July 2018	5/15	13	2
5 (2015)	1x1	SE 6556 6126	2nd July 2018	5/14	14	1
6 (2015)	1x1	SE 6557 6127	2nd July 2018	4/13	111	0
7 (2015)	1x1	SE 6558 6128	2nd July 2018	5/11	14	0
8 (2017)	1x1	SE 6558 6128	3rd July 2018	7/11	71	0
9 (2017)	1x1	SE 6528 6132	3rd July 2018	7/15	28	1
10 (2017)	1x1	SE 6494 6136	9th July 2018	6/16	14	0
11 (2017)	1x1	SE 6497 6144	9th July 2018	6/15	16	0
12 (2017)	1x1	SE 6496 6144	9th July 2018	11/12	137	0
13 (2016)	1x1	SE 6535 6174	3rd July 2018	9/11	47	2
14 (2016)	1x1	SE 6535 6173	3rd July 2018	6/15	26	1
15 (2016)	1x1	SE 6530 6174	3rd July 2018	7/14	15	0
16 (2016)	1x1	SE 6531 6173	3rd July 2018	3/16	4	0
17 (2017)	1x1	SE 6557 5957	13th July 2018	8/11	117	0
18 (2017)	1x1	SE 6558 5955	13th July 2018	9/12	197	0
19 (2016)	2x2	SE 6524 6098	26th June 2018	2/17	3	0
20 (2016)	2x2	SE 6528 6098	26th June 2018	3/22	7	1
21 (2016)	2x2	SE 6552 6122	27th June 2018	9/17	23	2
22 (2016)	2x2	SE 6551 6120	26th June 2018	8/18	30	3
23 (2016)	2x2	SE 6525 6132	27th June 2018	4/39	5	2
24 (2016)	2x2	SE 6516 6126	27th June 2018	7/31	13	2
25 (2016)	2x2	SE 6505 6125	27th June 2018	5/12	25	5
26 (2016)	6x3	SE 6522 6096	26th June 2018	8/56	17	1

Table 2 (see p94): Plant morphological measures scored for Creeping Willow patches.

Variable	Description	Value	Data Type	Method Details
Max height	Height of the tallest stem within a patch	To an accuracy of 1cm	Continuous	Tape measure
Mean height	Average height from max height and six other stem heights (where possible) - 3 taller and 3 shorter stems	To an accuracy of 1cm	Continuous	Tape measure
Max width	Greatest distance across a patch	To an accuracy of 1cm	Continuous	Tape measure

Mean leaf length	Average length of leaves calculated from six individual leaf length measurements	Measurements accurate to 1 mm, mean calculated to 2 decimal points	Continuous	Tape measure - measure the 4th leaf from the apex if possible. If unable to use 4th leaf, the 5th leaf was used.
Mean leaf density	The average number of leaves along a 10cm length of stem calculated from 3 separate counts from randomly chosen stems	1 - ∞	Continuous, integer	Tape measure, visual survey - measure a 10 cm stretch of stem from the midpoint between apical leaves and first subsequent leaves. If less than 10 cm, 5 cm or 2 cm lengths of stem were used and scaled up to 10 cm
Number of stems	The number of stems present within a patch	1 - ∞	Continuous, integer	Visual survey
Leaf hair abundance	Classification of amount of leaf hair on both leaf lamina surfaces	1 - 4	Discrete, ordinal, integer	Visual inspection - one of the following: 1 = all upper glabrous, lower very short hair. 2 = some short upper hair/glabrescent, all lower with short hair. 3 = all upper with short hair, lower with long. 4 = upper with medium hair, lower with very long hair.

Table 3. Pearson's correlations between the (log_{10}) Creeping Willow patch characteristics (Table 2). Numbers above and right of the diagonal are values of *r* and numbers below and left of the diagonal are two-tailed *p* values (n=451).

Variable	**Max. Height**	**Mean Height**	**Max Width**	**Mean Leaf Length**	**Mean Leaf Density**	**No. Stems**	**Leaf Hairiness**
Max. Height		0.935	0.297	0.349	-0.184	0.231	0.363
Mean Height	<0.001		0.098	0.306	-0.160	0.029	0.285
Max Width	<0.001	0.038		0.257	-0.255	0.860	0.310
Mean Leaf Length	<0.001	<0.001	<0.001		-0.559	0.221	0.310
Mean Leaf Density	<0.001	<0.001	<0.001	<0.001		-0.194	-0.104
No. Stems	<0.001	0.537	<0.001	<0.001	<0.001		0.375
Leaf Hairiness	<0.001	<0.001	<0.001	<0.001	0.027	<0.001	

A PCA on these logged plant measures showed that two Principal Components together accounted for 64% of the variance in plant measures (Table 4). The first axis (44% of variation) loaded all the variables fairly evenly, although negatively with maximum height, maximum width, mean leaf length and leaf hairiness, and positively with mean leaf density. Patches with more negative scores on this axis were taller, wider, and with longer, hairier leaves, but lower leaf density. In the field these characteristics signified larger, more robust patches. The second axis (21% of variation) most strongly negatively loaded mean leaf density and leaf hairiness and positively mean leaf length. Patches with more positive scores in this axis have longer leaves, which are less hairy and less densely packed. This axis possibly represents those patches with greater shoot elongation.

Table 4: Principal Component variable loadings, variation explained, and eigenvalues from an analysis of Creeping Willow patch measurements at Strensall Common (n=451). Variables are defined in Table 2 (see p97) and were $\log_{10}$ transformed and scaled prior to analysis.

Variable	PC1	PC2
Max height (cm)	-0.443	-0.353
Max width (cm)	-0.417	-0.234
Mean leaf length (mm)	-0.523	0.365
Mean leaf density	0.433	-0.644
Leaf hair abundance	-0.412	-0.523
Proportion variance explained	0.442	0.208
Cumulative proportion variance explained	0.442	0.649
Initial eigenvalue	2.21	1.04

Multi-model inference using quasi-Poisson errors and QAICc highlighted no other general linear models of the number of larval spinnings within 5 QAICc units of the best model. The best model (Akaike weight = 1.00, r^2 = 0.725) was one containing all main effects (dispersion parameter = 6.47). In the best model, the number of spinnings was higher inside exclosures than outside (Table 5), was higher on patches with lower PC1 scores ('larger' patches), and was higher on patches with lower PC2 scores (higher density of smaller, hairier leaves). Several plots had significantly fewer spinnings than plot 1 (plots 2, 3, 5, 9, 16, 21-25), but none had significantly more (Table 5, p100).

Small Chocolate-tip spinnings were also located at every other location surveyed casually in which Creeping Willow was found, including in the southern and restricted areas of the common, indicating that it is widely distributed at the site (Table 6, p100).

Table 5: Parameter estimates (SE) of the best general linear model of the number of Small Chocolate-tip spinnings per Creeping Willow patch, fitted with a quasi-Poisson error structure and log link. The intercept gives the value for plants outside Plot 1, all other factor level parameters are relative to this. Significant variables or factor levels are highlighted in italics.

Explanatory variable	**Estimate**	**SE**	**P**
Intercept	0.145	0.397	0.716
Inside plot	*0.978*	*0.188*	*<0.001*
PC1	*-0.714*	*0.100*	*<0.001*
PC2	*-0.676*	*0.137*	*<0.001*
Plot 2	*-1.898*	*0.877*	*0.031*
Plot 3	*-1.753*	*0.811*	*0.031*
Plot 4	-1.410	0.799	0.078
Plot 5	*-1.652*	*0.769*	*0.032*
Plot 6	0.584	0.419	0.164
Plot 7	-0.775	0.768	0.313
Plot 8	-0.135	0.492	0.784
Plot 9	*-1.318*	*0.600*	*0.028*
Plot 10	-1.183	0.777	0.129
Plot 11	-0.741	0.733	0.313
Plot 12	0.275	0.420	0.513
Plot 13	0.762	0.522	0.145
Plot 14	0.225	0.640	0.726
Plot 15	-0.606	0.754	0.423
Plot 16	*-2.692*	*1.318*	*0.042*
Plot 17	-0.086	0.455	0.850
Plot 18	0.847	0.454	0.063
Plot 19	-2.320	1.516	0.127
Plot 20	-1.583	1.042	0.129
Plot 21	*-1.595*	*0.658*	*0.016*
Plot 22	*-1.161*	*0.581*	*0.046*
Plot 23	*-4.038*	*1.202*	*<0.001*
Plot 24	*-1.814*	*0.804*	*0.025*
Plot 25	*-2.461*	*0.632*	*<0.001*
Plot 26	-1.359	0.737	0.066

Table 6: Locations of Creeping Willows surveyed casually containing Small Chocolate-tip spinnings.

Grid reference	**Locality name**	**Date surveyed**
SE 652 597	Kidney Pond	29th June 2018
SE 655 596	Wild Goose Carr	29th June 2018
SE 655 595	Wild Goose Carr	29th June 2018
SE 654 613	Grenade Range	3rd July 2018
SE 651 596	Kidney Pond	13th July 2018
SE 637 587	Towthorpe Common	13th July 2018

Discussion

The most striking feature of the survey was how abundant and widespread (Table 1 p97, Table 6 p100) leaf spinnings of the Small Chocolate-tip moth were on Creeping Willows on Strensall Common, given the limited distribution of this moth in Northern England and low frequency of previous records. We found evidence of Small Chocolate-tip larvae in every area where we found Creeping Willows, and on over a third of individual patches surveyed. Individual patches could sometimes contain very high numbers of spinnings (up to 100), but the most common abundance class was just a single spinning per patch when present. Skinner (1998) and South (1961) both follow Lambert (1841) in stating that larvae hide by day in their spinnings and emerge to feed by night.

Although we did not check every spinning to see that a Small Chocolate-tip larva had constructed it (such checks could potentially negatively affect larval fitness and on a survey of this scale, population fitness), our survey also contained regular observation of larvae outside spinnings (Table 1 p97), as also noticed by Horton (1861). We did casually open a small number of spinnings to give us confidence that Small Chocolate-tip larvae were responsible for making them and the only insects observed inside were of this species. Spinnings were sometimes unoccupied: this is also remarked upon by Greene (1856), whilst Horton (1861) states that larvae make a new spinning with every moult, which would imply that the number of unoccupied spinnings should increase as larvae grow. Our survey only covered a tiny area of the Common, although because it was targeted at another species using this as larval host plant, Dark Bordered Beauty, we did include many of the best growths of Creeping Willow on the Common.

It is difficult on the basis of these data to estimate exact larval densities and we do not attempt to. Although there is generally a correlation between abundance and occupancy or range size across species (e.g. Fraser *et al.*, 2008), such that those that are locally abundant also have high occupancies across their range, there is considerable variation across species, and some may have high occupancy but low local abundance or *vice versa*. On the basis of our data, Small Chocolate-tip may be an example of a moth that reaches high densities locally but has low range occupancy. Our survey is however only from a single year. In 2017 we also casually observed large numbers of spinnings in some plots, leading to our decision to survey more systematically in 2018, so our observations could be typical, though only repeat observations could determine to what extent.

Despite their abundance, spinnings were aggregated across patches, meaning there were more patches with no spinnings and more with higher numbers than expected by chance (Figure 2 p96). This is suggestive of preferential oviposition selection behaviour by adult females. However, because patches with many spinnings tended to be larger (Figure 5 p102, Table 5 p100) and because the unit of scale at which oviposition decisions are made is unknown other data are needed to confirm this. One likely consequence of the aggregation of spinnings across patches, however, is that large numbers of larvae might sometimes impact the growth of host plants if the burden of herbivory exceeds the plant's capacity to recover. Ormerod (1893) reports that this can sometimes occur, for example on Osier *Salix viminalis* crops grown for basket making in Galway, Ireland, where thousands of Small Chocolate-tip larvae could strip the leaves from terminal shoots. Given that all of our surveys were from areas of current importance for Dark Bordered Beauty moth, it could be that high densities of Small Chocolate-tip are negatively affecting Dark Bordered Beauty by reducing the health of its host plant. Where host plants

have died or look stressed following intense insect herbivory, this seems likely, given both moths' apparent preference for large patches (Robertson, 2005; Baker *et al.,* 2016). Another possible negative interaction is indicated by Shepheard-Walwyn (1898) who found that Small Chocolate-tip larvae could predate Puss moth larvae when both were kept in captivity on the same plants, even when host-plant foliage was plentiful. Whether such predation occurs on other plants and in the wild remains to be confirmed. A less extreme interaction was noted by Lambert (1841), who found that at night when feeding, Small Chocolate-tip larvae tended to distribute themselves on opposite sides of their breeding cage from other larvae, suggesting that larvae avoid each other, a potential result of interference competition that could decrease fitness of the species involved.

The fact that more spinnings were found on larger patches (Figure 5 p102, Table 5 p100), and more inside than outside exclosures (Table 5), suggests that the use of exclosures to protect Creeping Willow from vertebrate grazing does not only benefit Dark Bordered Beauty moth, but also other notable insects relying on the same plant. This effect is likely to be partly mediated by the greater size of patches inside grazing exclosures, which might provide greater nutritional content, but the data also indicate an effect of being inside exclosures that is independent of patch size (Table 5). This might be mediated by the absence of grazing by vertebrates (which might cause mortality of the juvenile moth stages), or other indirect environmental differences correlated with grazing exclosure.

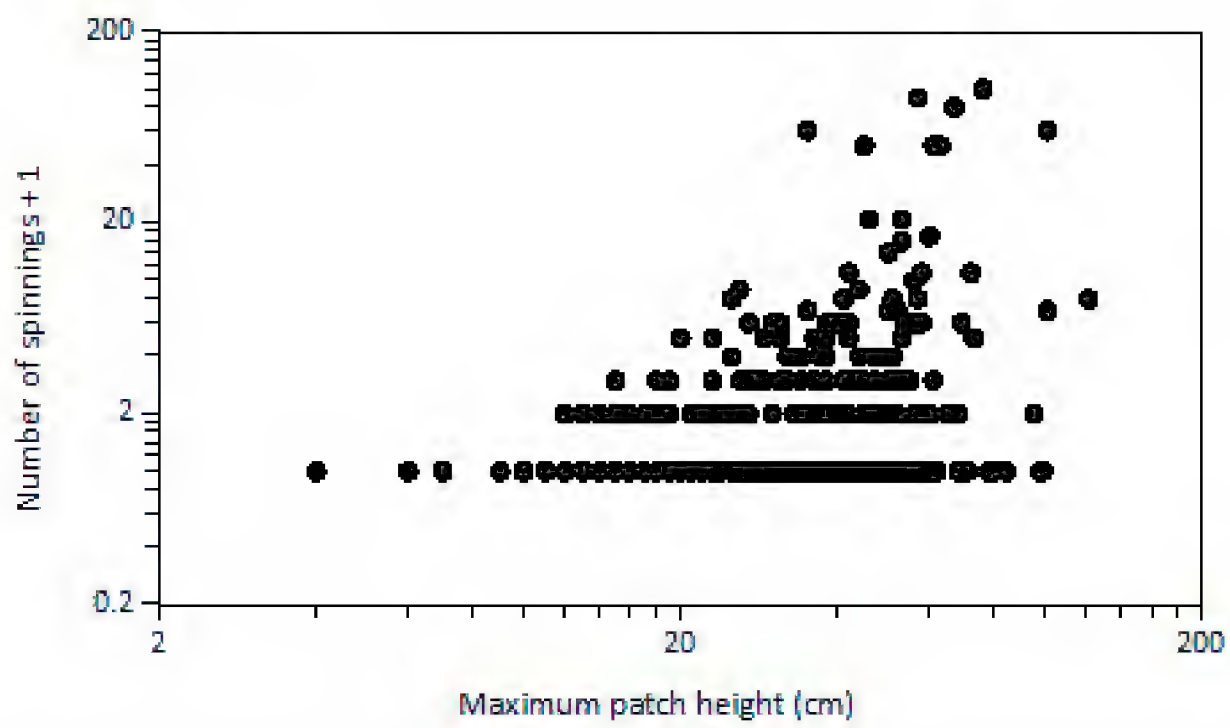

Figure 5. Number (x + 1) of Small Chocolate-tip larval leaf spinnings per patch (log scale) against maximum Creeping Willow patch height (also log scale).

Whatever the causes, our results provide an example of conservation targeted at one species having beneficial side-effects on another. Despite its small size, Creeping Willow can support large numbers of associated invertebrates; the Biological Records Centre database (https://www.brc.ac.uk/dbif/hostsresults.aspx?hostid=4990) lists over a hundred. This could make Dark Bordered Beauty not only a 'flagship' species for insect conservation (e.g. Gross, 2016; Thomas, 2016) but also a 'guild surrogate' for species associated with Creeping Willow (see Marcot & Flather, 2007).

The finding that PC2 was negatively related to the number of spinnings per patch (Table 5 p100) was surprising given that low scores on this PC axis probably represents patches with lower shoot elongation and hairier leaves (Table 4, p99). Trichomes often impede herbivore growth, but different herbivores react differently to trichome density, and growth of some may actually be improved (e.g. Tian *et al*., 2012). In addition, a higher density of leaves on a shoot provides potentially more food resources for small immobile herbivores, they may provide more opportunities to create a protective spinning, and a stressed plant with reduced shoot growth might be one that can invest relatively less in defences against herbivores. It is not obvious what explains the tendency for number of spinnings to vary across plots (Table 5). Plots 13 and 18, with the highest estimated numbers of spinnings, both contain old established patches with healthy patches outside the exclosures. Plot 23, which had lowest estimated numbers of spinnings, only contained introduced pot-grown plants, and patches outside the exclosure had been severely grazed. These factors may account for some of the variation, but there surely must be many other factors affecting abundance that were not quantified in our study.

Overall, our study provides evidence for a healthy population of an infrequently-recorded local moth that may be benefitting from conservation actions targeted at another moth using the same host-plant, perhaps to the detriment of the target species. Ideally a study should be conducted to relate Small Chocolate-tip distribution to that of Dark Bordered Beauty larvae and their fitness, and also the effect of Small Chocolate-tip larvae on Creeping Willow health. The former suggestion is complicated by the fact that Dark Bordered Beauty larvae were hard to locate even when the adult moth was much more abundant than it is presently (Robertson, 2005). Further surveys will help determine to what extent the population of Small Chocolate-tip fluctuates, and how it responds over time to changes in the size and abundance of its host-plant. To make population estimates for the whole site, the ratio of leaf spinnings to larvae, and also the total density of the host plant on the Common need to be determined.

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The changing fortunes of the Dark Bordered Beauty moth at York, 1894-1997, as recorded by the York and District Field Naturalists' Society

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One of the problems facing conservationists is identifying possible threats to the persistence of a species or population. Data on past population fluctuations over time, and their causes, can be valuable in identifying future threats. In this paper we report data on the changing fortunes

of a rare moth in the York region and assess the implications for its future conservation.

The Dark Bordered Beauty moth *Epione vespertaria* (Lepidoptera, Geometridae) is a Red Data Book species (Shirt, 1987), currently only known from a single English site, Strensall Common, about 10km north of York (Baker, 2012; Baker *et al*., 2016). Publications mention Yorkshire as a locality for Dark Bordered Beauty in the 1820s (Stephens, 1829), York itself is mentioned by the 1860s (Walker, 1860) and specific sites around York are mentioned by the 1870s (Anon, 1878). Initially the most mentioned site was Sandburn (e.g. Porritt, 1883), along the Malton Road (A64) , but later the adjacent site of Strensall (Figure 1), to the west of Sandburn, became better reported (e.g. Hewett, 1900). The moth was also collected at Askham Bog, to the south west of York in 1893 by S. Walker & R. Dutton, and again in 1898, but this fact was generally unrecognized until recently (Mayhew, 2018).

Figure 1. "Strensall Common" taken in 1944 by R.J. Batters, © Richard B. Walker. This view shows three entomologists engaged in daytime field collecting. During the Second World War, blackout regulations restricted night-time collection of Lepidoptera. Reproduced with permission from Richard B. Walker.

Because of its restricted distribution, concerns about the possible extinction of the Dark Bordered Beauty at York have long been expressed (Barker, 1886; Anon, 1897; Turner, 1898), and continue (Baker, 2012; Baker *et al*., 2016). A long term record of its changing fortunes would be a potentially valuable source of information for conservation. In a past review of Yorkshire Lepidoptera, Sutton and Beaumont (1989, p.204) reported that the status of Dark Bordered Beauty (at 'Strensall Common') "has been charted from 1894 to the present by the York and District Field Naturalists' Society [YDFNS] (JP [Joyce Payne] pers. comm.)." To evaluate the content of these records, one of us (PJM) visited the Archives of the Borthwick Institute at the University of York where the records are now kept and located the aforementioned records of Dark Bordered Beauty in the annual reports of the Entomology and Lepidoptera recorders. On mentioning this to his former colleague at the University, Terry Crawford, Terry sent him a copy of a typed but apparently unpublished manuscript written by Joyce Payne in 1983 containing most of the same extracts of text, combined with a small number of other observations and records, written to commemorate the publication of Porritt's list one hundred years beforehand and its mention of Dark Bordered Beauty at York (Porritt, 1883). PJM subsequently contacted JP and they agreed to publish the extracts jointly. The other authors here have been involved

in re-checking the records and in finding the other pertinent background literature reported here.

The York and District Field Naturalists' Society (YDFNS) was founded in 1874 at 13, Holgate Road, York, the house of painter but erstwhile entomologist William Prest (1824-1884). The Society, one of many field clubs in the north of England at the time of its founding (Alberti, 2001) served to organize excursions and exchange of natural history information in the York district, and also act as a forum where enthusiasts could gain the "sympathy of a crowd" (Wale, 2018). The Society was an affiliate of the Yorkshire Naturalists' Union (YNU) and its monthly meeting reports featured prominently in *The Naturalis*t, as well as other journals, in its early years. The Society eventually disbanded in 2002. In 2009 the records of the society were transferred to the Borthwick Institute. The records include several biological recording ledger books, two of which are "Entomology" (reference code: YDFNS/3/1/4) covering the years 1894 to 1943, and "Lepidoptera" (reference code: YDFNS/3/1/5) covering 1943 to 1997. These contain the annual recorders' reports on those subjects, which were handwritten in the former volume but in the latter volume often typed on loose sheet paper and pasted in.

Below we report the text from these two volumes relating to Dark Bordered Beauty moth and then discuss its implications. We include the names of the Recorders (i.e. the authors of the annual reports) at the end of each excerpt, where relevant, although some more recent names are withheld to comply with General Data Protection Regulations. The Dark Bordered Beauty is variously referred to in the text either by its usual vernacular name or *E. vespertaria*, *Vespertaria*, *E. parallellaria*, *E. parallelaria* (understandable mis-spellings of the official synonym *E. paralellaria*), 'Red Bordered Beauty' and on one occasion the 'Bordered Beauty' (the vernacular name for a different species, although the context makes it clear that this refers to *E. vespertaria*). Strensall was spelt "Strensal" by Arthur Smith throughout, and Ralph Moore spelt Sandburn "Sanburn", as we have also seen on some specimen labels in museums. We have italicised the scientific names where appropriate although this was generally not indicated in the actual text. Some explanatory text is also inserted in square brackets throughout.

Reports

1894. "*E. vespertaria* (larvae and imagos) Sandburn S.W. [Samuel Walker], W. [William] Hewett"

1895. "Mr Hewett records….*E. vespertaria* not common."

"Noctua. Now I come to a family who love and delight to revel in the dark, and often compels us to keep bad hours, and sometimes have to come rolling home in the morning bogs[?] but to the ardent Entomologist he is always at home amongst his tiny friends whether it be in the bright early sunshine in company with *Vespertaria*, or in the dark midnight hour surrounded by his ever-faithful friends and companions *Polyodon* [Dark Arches] and *Pronuba* [Large Yellow Underwing]." Robert Dutton.

1896. [Evidently R. Dutton] "*Vespertaria* was as usual out in July in fair numbers, in its only habitat [note no mention of Askham Bog], though not so easily captured as formerly owing to the vegetation on the common [presumably Sandburn, though this is not specifically mentioned] becoming more dense."

"*Vespertaria* in the larva state was not difficult to procure."

1897. "Larva of *E. vespertaria* were swept by the 25th [June]." Samuel Walker.

1898. "[May] 19 Mr Dutton gives the hatching of ova of *E. vespertaria*. Mr Hewett on the 25th…..[;] June 5 I have a record giving the larva of *Vespertaria*… as half grown….[;] July 13th

Larvae of *E. vespertaria* described as "full fed" Mr. H. [Hewett]." S. Walker.

1899. [Report not signed but is in the handwriting of William Hewett] "*Epione vespertaria* was taken in the larval and imago state at one of its few British localities Sandburn Common near York by Messrs Hawkins Dutton Walker Ash & Hewett."

1900. "Mr John Hawkins send me the following particulars of captures....July *Epione vespertaria* Sandburn at rest and on the wing."

"Mr R. Dutton reports....larvae of *Epione vespertaria* common at Sandburn Common and says a large percentage were ichneumoned...."

"Mr William Hewett's most interesting captures for the year are as follows....June 21...larvae of *Epione vespertaria* obtained at Sandburn."

"July 15, Mr Thwaytes of Carlisle & I at Sandburn Common in the evening we got *E. vespertaria*.... August 1st L. S. Brady of Sheffield & self at Sandburn we got several *Vespertaria* male and female but they were mostly worn." William Hewett.

1901. No annual report. 1902. No mention.

1903. "July 1 1903 Mr R. Dutton (one of our worthy and much esteemed veterans) obtained larvae of *Epione vespertaria* the Bordered Beauty moth at Sandburn near York, its principal habitat in Britain...." William Hewett.

1904. No mention.

1905. "It is gratifying to note that notwithstanding the large numbers of larvae which are obtained each year by some of the York collectors and their friends, the very local *Epione vespertaria* was in abundance near York on the night of 15th July..." William Hewett.

1906-1907. Reports missing, two blank pages, and the next report is written by a new recorder.

1908. No mention.

1909. "On Jan 25th 1910 a paper on the Entomology of York district for 1909 was delivered to our members by Mr G. Machin, and he gives a full list of 133 different species noted or captured by him during the year. ....among other interesting insects may be noted, on Strensall Common..... *Vespertaria* (scarce)...." Ralph Moore.

1910. [Moore's records] "July 27th... *E. vespertaria* [at Sanburn].... On the 29th [July] *E. vespertaria*... taken at Sanburn. Sanburn again on July 31st....*E. vespertaria*... Sanburn August 3rd...*E. vespertaria*.... Sanburn August 6th...*E. vespertaria*." Ralph Moore.

1911. No report.

1912. [A. Smith's list of captures for the year]"..., *E. vespertaria*,...".

1913. "My next entry is for July 12 at Sandburn, *E. vespertaria* being the best capture. The home of this species is getting much overgrown, which stunts the growth of the Dwarf sallow, its food plant, making the insect more difficult to get each year." Barry Varey.

1914. "At Strensal on the 11th of July I took 10 male *Vespertaria* & several more on the 18th including 1 female.... At Strensal on Aug 1st I took 4 female *Vespertaria.*" A. Smith.

1915. No mention. 1916. No annual report.

1917. "At Strensal on the 22nd [July] I took a var of the Red Bordered beauty (*Epione vespertaria*) without the network markings in the centre of the wings [probably *ab. fulva* Cockayne, 1934],

& also several females in the daytime." A. Smith.

1918. [Report contains just a single paragraph and was evidently unfinished but in A. Smith's handwriting]. No mention.

1919. "On July 8th at Strensall....*E. vespertaria* was very scarce, the place where I knew it so well being destroyed by fire. A later visit to Sandburn yielded a few males & one female...." A. Smith.

1920. [not signed but in A. Smith's handwriting] "I tried several times in the early part of August for our old friend *E. vespertaria*, but it never turned up." [Probably referring to Sandburn].

1921. "I visited Sandburn early in August to see how the Red Bordered Beauty was faring but was disappointed to find none, I also tried Strensal but in vain, the fire of 1919 seems to have exterminated the species altogether in its old haunt at the Malton Road end of the Common." A. Smith.

1922. "Only once during August I visited Strensal Common to see if *E. vespertaria* was still in existence, but was not successful in seeing it.... The following records have been handed to me by Mr Fabian.....Aug 6th he took 1 male *Vespertaria* on the Common [Strensall]." A. Smith.

1923. No mention.

1924. "Early in Aug I visited Strensal & had the pleasure of capturing our old friend *Vespertaria*, 2 males & 1 female, this came as a surprise, we had almost given up hope of seeing it again, the fire in the locality a few years ago practically exterminated it & the felling of timber in the adjoining woods also took its toll." A. Smith.

1925. "At Strensal in late July also three specimens of the Red Bordered Beauty (*E. vespertaria*), these two records are the most cheering as recently we have been afraid of their disappearing from our list altogether." [Handwriting and spelling is A. Smith's.]

1926. "A gardener near Murton.... asked me to name certain insects he had caught & set ["on Strensal Common"], among them being *Vespertaria* & *Strigillaria* [Grass Wave] neither of which I have been able to record myself this year." A. Smith.

1927. "The following day July 24th I had the privilege of seeing our old friend *E. vespertaria* at Strensal, for some years the fate of this species has been in the balance, but this season it seems to have survived the storm, the Dwarf Sallow on which the larvae feed were almost underwater, but one good omen in its favour, was the fact of seeing myself 5 females; this being a good number, even as compared with the old days when the insect was plentiful..... Mr Fabian records....Strensal 7th & 14th Aug a few *Vespertaria*, one female." A. Smith.

1928. "On July 19th at Strensal again, *E. vespertaria* I am pleased to say still survives & doing well, the early swamp had not taken its toll altogether. I found two females, later in the evening....a few male *Vespertaria* but no females."

"Mr Machin records....On the afternoon of July 20 & again on July 23 visited my old *Vespertaria* ground on Strensal Common & found the insect fairly plentiful, but apparently in a very limited area & therefore forebore to take more than 2 or 3."

"Mr Sowden records....last two weeks in July...*Vespertaria* few females, no males." A. Smith.

1929. "At Strensal on June 17th I found several larvae of *E. vespertaria* almost full fed ..."

"On June 26th...Coming back by Malton Rd I called at Strensal & picked up a few more *Vespertaria* larvae..." A. Smith.

1930. "June 16th at Strensal I had the pleasure of sweeping half a dozen *E. vespertaria* larvae off the Dwarf Sallows."

"At Strensal on Aug 1st I made captures of ...*E. vespertaria*." A. Smith.

1931. "Strensal on the 22nd June....on the Dwarf Sallow I swept larvae of *E. vespertaria*...but [compared to other species] *Vespertaria* were rather scarce."

"At Strensal on July 21st I took several *E. vespertaria*. *Vespertaria* I am pleased to report is steadily increasing. I myself found 7 females in two visits, all in daylight, for years past it was nearly impossible to find a female at all, especially in the day-time, it usually comes out about midnight & then has to be carefully searched for." A. Smith.

1932. No mention.

1933. "On the 23rd of June *E. vespertaria* larvae were found feeding on the Dwarf Sallows in the same habitat as usual, successive fires in the last few years no doubt having diminished the species a good deal, it is pleasing to report its survival. ...On July 12th *E. vespertaria* was on the wing...." A. Smith.

1934. "At Strensal on Aug 8th *E. vespertaria* was seen again but very scarce." A. Smith.

1935. "On July 22nd I visited Strensal again, *E. vespertaria* being the objective, only one specimen of a male was found."

"Aug 3rd at Strensal again....three specimens of *E. vespertaria*." A. Smith.

1936. "On July 20th I bred out two *E. vespertaria*, both males." A. Smith.

1937. "On June 12th [near an oak tree behind Sandburn]...*E. vespertaria* [larvae] were certainly more plentiful on this part of the common than I had seen elsewhere. These emerged on Aug 5th." A. Smith.

1938. No mention.

1939. [Insert taped into the book, unsigned but in A. Smith's hand]. "Records for 1939. On the 6th of June *Epione vespertaria* larvae were found at Strensal, three were duly reared."

1940 and 1942. No mention. 1941. No annual report.

1943. [Pasted in, before 1942]. "*Epione parallelaria*. While beating larvae from Birch on Strensal Common on July 27th one male *parallelaria* was captured. Further search amongst the Dwarf Sallow revealed many others, including two females one of which laid a number of eggs which I hope to rear next year. This part of the common has been badly mutilated by military manoeuvres recently, but so far this rare local insect fortunately still survives." [Hand of A. Smith].

1944: "662 [the number of this species in one check list] *E. parallellaria* Schiff Strensal Common. Still surviving after tanks have almost ruined the area. Males were disturbed in fair numbers 25/7." [Spelling of "Strensal" suggests it was written by A. Smith].

1945-1956. No annual reports.

At the start of the second volume "Lepidoptera" is a numbered species list by Heslop (published 1947) "stuck in this book by the late Arthur Smith of York c. 1949 and the first entries made by him". Dark Bordered Beauty appears as number 839. Next to this number some records are briefly noted. Most of these repeat some of the records elsewhere in this and the other volume, but the following two do not:

"1946 Strensall". [This is an erroneous record listed in the original manuscript by JP under "K. G. Payne accompanied Arthur Smith on a sugaring expedition to the Towthorpe Lane site and brought one specimen 13/7". We have checked this information against the specimen label, which is of a male, but captured in 1947: "Strensall 13/7/47"].

"1979 reported".

1957. "Strensall Common was visited many times….not forgetting the Dark Bordered Beauty. Strensall is now about the only known locality for this species." [No recorder mentioned, but Eric Richards of Holgate, York, was the recorder 1957-67.]

1958-59. No mention.

1960. "At Strensall I saw….Dark Bordered Beauty…"

1961. "Our local rarity the Dark Bordered Beauty was also present in fair numbers…"

1962. "At Strensall…while our local rarity, the Dark Bordered Beauty was very scarce, the whole area where it occurs having been burned off by an early spring heath fire."

1963. No mention.

1964. "Our local rarity – the Dark Bordered Beauty, occurred in fair numbers at Strensall Common, this was very pleasing for Strensall Common had suffered badly from fires early in the year, it has just been redrained by the Army and I fear that this may make it drier still and thus more prone still to fire, this of course can only result in a further reduction in the insect population." [Figure 2 p111].

1965. "On the 11th August we held a meeting at Strensall Common and a female Dark Bordered Beauty was found. I introduced this moth on to the [Yorkshire Wildlife Trust] Nature Reserve - this makes 2 females which I have released on the Reserve, let's hope they multiply and become a thriving colony." E. Richards.

1966. "The Dark Bordered Beauty, our local rarity was once more fairly common on Strensall Common during August."

1967. [At Strensall]. "The Dark Bordered Beauty was seen in fair numbers, this is now the only known place ti [mis-typed] occurs in the British Isles."

1968-1979. No annual reports.

The following record is mentioned in the original manuscript by JP "1971---…observed *E. vespertaria* at Strensall Common 18/7", but this is not in the annual reports, which are missing.

The next line says "1978--- 2 female and 1 male Dark Bordered Beauty were observed on pine trunks on Strensall Common one evening".

1980-1982. No mention.

1983. "Among the Strensall specialities found….also the Dark Bordered Beauty".

1984-1992. No mention.

1993. "…has again sent me a good list….mostly from VC61-62….the most notable are ….Dark Bordered Beauty…."

1994-1996. No mention.

site of Special Scientific Interest, so that should the question ever be raised regarding the insect population of a particular site, we hope that we would, in the course of time, be in a position to answer it.

Our local rarity - the Dark Bordered Beauty, occurred in fair numbers at Strensall Common, this was very pleasing for Strensall Common had suffered badly from fires early in the year, it has just been redrained by the Army and I fear that this may make it drier still and thus more prone still to fire, this of course can only result in a further reduction in the insect population.

Late August and early September at Skipwith Common at night proved to be very productive and moths were everywhere on the grasses.

In September I had a good emergence of the Barred Sallow from larvae taken earlier in the year from a Maple at Appleton Woods, this is a very good moth for York.

Figure 2. A page from the "Lepidoptera" recorder's annual report book of the York and District Field Naturalists' Society, showing the 1964 report typed by Eric Richards. This report expresses concern at the effect of heath fires on the Dark Bordered Beauty population at Strensall. Reproduced from an original in the Borthwick Institute, University of York (YDFNS/3/1/5).

For "1997 >" there is a Bradley & Fletcher species check-list written out in numbered order, with just two records for 1997 against two butterflies; Holly Blue and Peacock, and there is no entry for Dark Bordered Beauty.

Discussion

The above text contains many previously unpublished records of Dark Bordered Beauty from the York area. The records document interesting biology, potential population fluctuations, including the disappearance of the moth from Sandburn, along with several potential causes of these fluctuations.

One of the most striking changes in the records is how their location changes from Sandburn in the early records to Strensall in the later records. Sandburn is first mentioned in 1894 and last mentioned in 1937. However, this last mention is ambiguous as it refers to a location "behind Sandburn". The previous unambiguous record from Sandburn is from 1919. This was followed by two years in which the moth was not recorded from either Sandburn or Strensall. The record books indicate that Arthur Smith went to Sandburn many times each year for many years afterwards and, given the absence of further records, it seems likely that the Dark Bordered Beauty effectively went extinct there around 1919. In contrast, Strensall records range from 1909 to 1983 and the moth is still extant there. The absence of earlier records from Strensall probably does not indicate that it was formerly absent there, but rather that Sandburn was a more profitable and accessible (and well-published) site in the days before motor transport, being a short walk along the Malton Road from Warthill Station, and access was not limited by military training. Records from museum specimens and published works may further confirm when extinction of Dark Bordered Beauty at Sandburn occurred, and these are currently being assembled.

Some potential causes of the Sandburn extinction are mentioned in the records: in 1896 Dutton mentions the vegetation becoming dense. In 1913 Varey mentions the vegetation becoming overgrown and unsuitable for the host-plant, Creeping Willow *Salix repens*, and indicating a decline in the population of Dark Bordered Beauty. In the following few years the records are mainly from Strensall, perhaps indicating that it was becoming a more profitable site to visit. In 1919 a fire is mentioned as destroying a site where the moth occurred on Strensall Common but in 1921 this fire is indicated to have been at the Malton Road end (i.e. eastern side) of the Common (perhaps Worlds End). Timber felling is also mentioned as a contributor in 1924, presumably because of the effects on other vegetation. It seems therefore that Dark Bordered Beauty declined at the eastern end of its York range simultaneously, and from more than one cause. The population at Strensall evidently recovered, but not that at Sandburn, which was subject to a more systemic deterioration in habitat quality. The 1854 OS six-inch map shows that much of Sandburn was already forested, though possibly of quite an open nature, and the area behind the Windmill Inn (now the Four Alls pub) known as 'The Kings Moors' contained heathy areas, some extending north-west to Worlds End and Wild Goose Carr. The 1912 map shows the heathy area at Kings Moor much reduced by afforestation. Sandburn and Kings Moor today contain mature conifers and some more mixed woodland areas, with a sometimes-dense understorey of Rhododendron. Both "Kings Moor Plantation and Sandburn Wood" were listed in the draft City of York Biodiversity Action Plan (City of York Council, 2013) under the category of "Sites of Local Interest for Lowland Heath and Acid Grassland" as an "Area of conifer woodland with relict heath and acid grassland on ridesides and beneath woodland." Given the success of heathland restoration projects nationwide (https://www.forestry.gov.uk/forestry/infd-6tt9qt), including at Worlds End and other Yorkshire sites, habitat restoration of Sandburn would still seem possible.

The above mention of fire is not the only one; fires are also mentioned as destructive in 1933, 1962 and 1964. In 1964 drainage is mentioned as a potential contributor to future fires. The damaging effects of fire were experienced again in 2009-10 by the destruction of a part of the best breeding habitat for Dark Bordered Beauty (Baker, 2012; Crawford, 2012; Baker *et al.*, 2016). Creeping Willow can survive fire in its subterranean parts but the overall density and size of patches can be badly affected (Baker *et al.*, 2016). In contrast, floods are mentioned as a concern in 1927-28, although no ill effects were detected. Floods during winter might not be damaging to dormant eggs, although there is no firm data on this. Larvae might be more affected but could potentially relocate, and flooding is probably less common in May or June (when larvae are present) than in winter (when eggs are).

Other threats mentioned include damage by military activities in 1943-1944, although the moth again survived; and potential damage by collectors at Sandburn in 1905. Damage from military activities has been much reduced since 1945 and may reduce further with the closure of the Strensall barracks, though that may bring other new challenges. The absence of, or presence of short or unfinished, reports during times of war (1914-1918, 1939-1945) reminds us that biological recording becomes something of a low priority during wartime. In addition, blackout regulations in both world wars must have restricted night-time recording of moths. Recording may have become especially difficult in the case of Dark Bordered Beauty because Strensall Common is a military training area, with presumably more restricted access.

Damage to rare insect populations from collectors was a very pressing concern in the 19th Century. The severity is mentioned by Morris (1871) who notes over 200 being taken by one collector, and Turner (1898) relates how some collectors took that many in a single day, and

returned every day for a fortnight. This may explain why the presence of Dark Bordered Beauty at Askham Bog was apparently unpublished by the collectors themselves (Mayhew, 2018). It is telling that one of these collectors, Robert Dutton, mentions Sandburn as "its only habitat" in 1896 above, despite collecting it at Askham in 1893. William Hewett, who expressed concern at the effects of collecting in 1905 above, also wrote a paper (Hewett, 1900) adding to the Dark Bordered Beauty sites mentioned by Porritt in 1883 but does not mention Askham Bog. Hewett was a very close friend of Dutton and Walker, who collected Dark Bordered Beauty at Askham, and must certainly have known about it, but he omits mention of it here. It seems likely therefore that the Askham population was kept secret for fear of attracting collectors to it. Collecting during the 19th and early 20th Centuries would have been concentrated at Sandburn and may have contributed to the loss of the Dark Bordered Beauty there. Almost all amateur lepidopterists today take photographs where possible rather than specimens, so the risk today is much lower, if still tangible.

One interesting record is of a female (the second of two) being released onto the Yorkshire Wildlife Trust (YWT) reserve in 1965 by Eric Richards. The YWT reserve was subsequently and for many years a favoured place for the public to find the insect and was noted as a 'hotspot' by Robertson (2005), although the moth did become extinct in the reserve area covered by the monitoring transect in 2011 and has still not recolonized it (Baker *et al*., 2016). Translocations of females might be a simple way of spreading the population onto new locations on the Common, as well as to other sites in future, given that it seems to have worked in the past. However, Anon (1886) mentions Carrington and Prest having attempted several unsuccessful introductions to other sites.

Another feature of the records above is how often the population seemed to fluctuate from common to scarce: in sequence the comments indicate: 1895 "not common", 1896 "fair numbers", 1905 "in abundance", 1909 "scarce", 1913 "more difficult to get each year", 1919 "very scarce", 1920 "it never turned up", 1921 "I tried in… vain", 1922 "was not successful", 1924-25 small numbers found, 1927 "a good number", 1928 "doing well" "fairly plentiful but… in a limited area", 1931 "steadily increasing", 1934 "very scarce", 1935 "only one", 1943 "many", 1944 "fair numbers", 1961 "fair numbers", 1962 "very scarce", 1964 "fair numbers", 1966 "fairly common", 1967 "fair numbers". The lack of records in later years is apparently because Strensall was less commonly visited and monitored, with moth records being dominated by those from garden light trapping. Caution should be applied to these anecdotal observations, as standard monitoring has shown that the flight season of Dark Bordered Beauty can vary by around two weeks annually and can be only 2-3 weeks in duration, so absence or scarcity on a particular day does not mean that the population was low that year. In addition, numbers at a particular locality might not represent the population more generally, for concentrations can occur in very limited areas (Robertson, 2005). These misgivings accepted, the observations are consistent with the more recent changes in numbers experienced since the monitoring transect was set up (Baker *et al*., 2016). It is therefore likely that the Sandburn-Strensall population has gone through successive bottle-necks and, combined with the general loss of range, this implies that the population is particularly at risk both genetically and demographically. It is remarkable that it has survived to this day given the threats and fluctuations implied in the records. It is important that this 'survival' history does not lead to complacency about its future, as has occurred in the past (Baker *et al*., 2016).

The mention of the specimen collected at Towthorpe Lane (the southern end of the Strensall Common SSSI) in 1947 is interesting, as this is a less commonly surveyed locality in the live

firing zone of the army training range. The last record in the Yorkshire moth database from this most southern part of the Common is from 1960 (www.yorkshiremoths.info), although there is a record from a little further north from 2004. Surveys on single days in July 2013 and 2018 failed to locate it there, despite the presence of Creeping Willow. It may be that the Dark Bordered Beauty has disappeared from this end of the Common.

A final interesting observation is the comment in 1900 by Dutton that a large percentage of larvae had been "ichneumoned". Further studies of parasitoid-induced mortality might be interesting given that this can sometimes drive host insect fluctuations, and might be implicated in the declines of some other Lepidoptera (e.g. Gripenberg *et al.*, 2011). The presence of specialist parasitoids would add an extra incentive to conservation action for both the moth and its parasitoids.

Overall, the YDFNS annual recorders reports provide remarkable and very personal insights into the changing fortunes of one of Britain's rarest Lepidoptera species, as seen through the eyes of the locals who knew it best. It is possible that examination of specimen labels in museums and of the published literature will similarly reveal evidence for some of the changes suggested above, and this work is in progress. The records might contain many other insights into the past biology of other Lepidoptera in the York district, and also contain a rich social history of a local group of enthusiasts. This legacy is one which the YNU has done much to encourage through the years.

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Monitoring Dark Bordered Beauty moth at Strensall Common, 1957-1963: some personal recollections

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In 2016 one of us (PJM) was invited to give a talk at the UK moth recorders meeting in Birmingham on 28 January 2017 about the recent work monitoring Dark Bordered Beauty moths *Epione vespertaria* (Lepidoptera: Geometridae) on Strensall Common near York (see Baker *et al*., 2016). The Strensall population is thought to be the only surviving population of this moth in England. Just prior to the meeting RBW (VC59, South Lancashire, moth recorder) made contact to relate his own experiences of monitoring this moth at Strensall Common during his teens and early twenties. Subsequent correspondence brought to light some interesting details of the monitoring in those days, which seems to have gone otherwise unmentioned in the published literature. The purpose of the current note is to make these available to subsequent researchers interested in the natural history of the moth and the social history of the people who have monitored it.

Richard writes:

> "I was born July 1941 in York but brought up in New Earswick, a village just north of York and about 25 minutes (by bike) from Strensall. I went to Ackworth School near Pontefract as a boarder; this is the co-ed school run by the Society of Friends and has sister and

brother schools in York known as the Mount and Bootham Schools. Ackworth School had a thriving Junior and Senior Natural History Society which met alternate weeks for about two hours. This was run partly by the Head of Biology, one Victor Mendham, a very enthusiastic naturalist and well known for his expertise in vascular plants. Senior pupils were expected to give short talks on their particular branches of natural history, show visiting speakers around the school and give the vote of thanks at the end of their lectures.

"Victor Mendham arranged natural history trips lasting about ten days during the beginning of the summer holidays: I visited the Channel Island of Alderney twice and then the Fair Isles, sailing from Newcastle. After an Alderney visit it was recognised I had added six new moth species to the Island's list. Luckily I had kept and set these moths, as the Jersey Natural History Society asked for them. I was most annoyed when months later they arrived back minus their abdomens: "gen. det." was unknown to me at that time!

"After gaining first prize in the school's annual Senior Natural History competition I bought, second hand from Godfrey's near Micklegate Bar, two large volumes by a local moth expert living near York for the sum of £1.17s.6d. *Moths found in the district of York* is a summary of the title: how I wish I'd kept it. The illustrations of each species were hand-painted and descriptions gave flight dates, food plants and local place names where the moth had been recorded. As one would expect Dark Bordered Beauty was listed as found at Strensall.

"Between 1957 and 1963 I helped monitor Dark Bordered Beauty on three sites on Strensall Common, giving my results for that area and for Askham Bog at the July A.G.M. of the Yorkshire Naturalists' Union (YNU) in Wakefield. No Dark Bordered Beauty were present then at Askham [cf Mayhew, 2018], but Goat Moth I think was one of the important species. It was at Askham that I had my first experience with sugaring. The addition of rum to the mixture not only brought in more moths but, when added to a pile of raisins which were left for the evening in a quiet ride, rendered the pheasants unable to walk, let alone fly. Even in the late 1950s food was still rationed! At the YNU AGM, accompanied by Vic Mendham, I read my notes and stumbled over the taxonomic names, while the committee of five elderly and bearded gentlemen in tweeds did their best not to smile! I thought, however, little did they know that for three years I had sent my melanic moth data to Dr H.B.D. Kettlewell at Oxford University and received congratulating letters saying that my "results were better presented than many professionals".

"The main site for Dark Bordered Beauty in those days was on common/public ground north, and a little east, of the Strensall Barracks, approximately at SE65296070. At SE64926130, at the main road junction with a track which passed over the railway, I left my bike. Small numbers of the moth could be found at SE64776156, a boggy, grassy area in which skippers were seen in their hundreds.

"The main site where the moth flew was not more than 75m by 45m. Over those years it wasn't a moth which strayed from a defined area; perhaps that was a disadvantage. On a good day I/we could pot around 45 male moths which were reluctant to fly very far. I can't remember ever netting in flight a single female, though around ten or so would be

seen on the vegetation within that area. I can't be sure of the date but possibly in 1959 half the site was destroyed by fire, in a very hot summer; a glass bottle was suggested as the cause. I'll pick up on the consequences of this fire in more detail later.

"A third site was some two miles away, along Towthorpe Moor Lane. On the south side was a municipal tip covered in willowherb which, as South (1948) suggested, would have Elephant Hawk moth larvae coming up the stems in the late afternoon. Yes, they did. On the north side of this over a double barbed-wire fence and passing notices which said "Keep out, live ammunition" one came to the site after about 100m (SE64955870 or SE64875867. I think I remember the drainage ditch which runs north-south). Young moth-ers intent on making discoveries were oblivious to such notices! I wondered if this site, because of limited access, was monitored much beyond 1963 or indeed what was or is the moth's status here.

Figure 1. Voucher specimens of Dark Bordered Beauty (female and male) captured on 28 July 1961 on Strensall Common by Richard B. Walker, in his personal collection.
© Richard Walker.

"During this time I often met two old moth-ers who were inspirational and very helpful to me. One Arthur Smith said that Dark Bordered Beauty was always uncommon, in fact I didn't really appreciate then how uncommon it was. He came yearly to Strensall Common to see it when Queen Victoria was on the throne. How about that, some history? The second man I think was a Mr Jackson. In those days young boys didn't ask nor were encouraged to call a "senior" by their first name, though under certain circumstances the Yorkshire "hey mister" might have happened. S.M. Jackson was as I remember my main tutor and companion on many occasions at Strensall. He lived up near the old Windmill on

the A59 beyond Blossom Street and worked at the Rowntree Coco Works on Haxby Road. As he was unknown to my parents, and as I was meeting him on the Common and at his house, my father, Director of Research Engineering at Rowntree & Co., sought him out, liked him and so I was allowed to continue my moth education with him! He was a fanatic at breeding through moths; the garden and area around the house, a smallish one, was full of pots, plants, and labels, and all sleeved. I know he regularly bred and released Dark Bordered Beauty. Some of us did breed the moth on occasions, releasing the emerged examples back on the site. In those days cameras and film were very expensive and the Yorkshire Naturalists' Union often demanded proof so I still have one male and one female Dark Bordered Beauty in my voucher collection (Figure 1 p117).

"In 1962 I wrote and had bound a small monograph on the Lepidoptera of the York district (Walker, 1962). This monograph was really about fulfilling a challenge. My uncle R.J. Batters saw the simple, inefficient and crude method I had of taking macro-photos of moths. The challenge was that if I produced a book on my mothing experiences in which I had to include lists and also some experiments, I would be given a Konica SLR, with Konica 1, 2 and 3 supplementary lenses and a Western 5 light meter. RJB tested all the latest cameras for Saville's, the photographic shop near Monk Bar, and so got all camera stuff at a decent discount. Hence my monograph with its moth experiments, listed in the index.

"Figure 2 (p119) is a photo of the main site where Dark Bordered Beauty could be found between 1957 and 1963. The ditch, to which I refer below, can be seen running from left to right in the near foreground showing larger bushes of dwarf sallow [Creeping Willow *Salix repens*]. I previously mentioned that a summer fire damaged part of this area. The fire was contained on one side by the ditch which meant that this site was split into two. A number of people, including myself and Mr Jackson, helped move to the larger unburnt part of the main site those moths which appeared cut off. We did this over a number of afternoons being diligent to look for the females. Mr Jackson certainly took larvae, bred them through and released them the following year."

The monograph written by Richard (Walker, 1962) contains the following text:

"The rarest moth caught near York is the Dark Bordered Beauty, *Epione vespertaria*, which I found on Strensall Common. R. South in "Moths of the British Isles" vol II (1948) states that "odd specimens have been recorded from Norfolk, St Ives, Newbury and Arundel, but chiefly occurs near York."

"During the last few years only about four entomologists from the Yorkshire Naturalists Union, have known of the exact locality of this rare insect, myself included. Entomologists come annually to ask its whereabouts but are refused because the colony is at present a very small one; about one hundred and fifty individuals were seen and recorded last year over a period of about two weeks. The breeding area is well contained by silver birch trees, which luckily stop the insects' colony from being distributed by winds. The area is about seventy five yards long and forty five yards wide, and here, by the side of a small ditch which runs through the colony, the dwarf sallow (the food-plant) grows [Figure 2]."

Richard continues:

"After 1964 I left York but never gave up my interest in moths, mostly recording on the Sefton Coast in Lancashire for the last 34 years. I now work one day a week in the Liverpool World Museum Entomology Department and for six years have been VC59, South Lancashire, macro and micro Recorder with a primary aim of co-opting others to study and record moths. A second aim is to support the continual work on the SSSI area of the Sefton Coast by advising the MOD Altcar, Formby National Trust, and Sefton Council, on the restoration and forward planning of this highly specialised sand dune and dune heath area".

Figure 2. The site of the Dark Bordered Beauty, 1961. From Walker (1962), this photo depicts the main site monitored in the northern part of Strensall Common. © Richard B. Walker.

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Thomasine Tunstall and an annotated copy of Gerard's 'Herball'

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Introduction

Our knowledge of the flora of northern England in the 16th and early 17th centuries is based almost entirely on books written by John Gerard and John Parkinson. Both these men were born in the north of England but moved to London to establish themselves as a surgeon and an apothecary respectively. With busy professional lives their botanising was mainly restricted to south-east England. They relied on friends and relatives to supply them with specimens from the north. For example, Thomas Hesketh of Clitheroe supplied both with material for their books. Another local plant collector was Thomasine Tunstall, who sent plants to John Parkinson. It may be claimed that she is the first recorded woman botanist in England. Whilst very little is known about these local collectors I concluded a previous article (Pearson, 2011) by suggesting that they may have owned one or more of these early botanical books and perhaps annotated copies exist in private or public collections.

In 2017 I was contacted by Richard Selby, who informed me that a copy of Gerard's 'Herball' of 1597 had been sold in London by Sotheby's. The auctioneers believed that it had belonged to Thomasine Tunstall because there were extensive annotations with the locality of many plants in Yorkshire and Lancashire. The book had been sold in 2012 - so who had bought it and where was it now? With the assistance of the auctioneers we quickly established that it had been acquired by the Folger Shakespeare Library in Washington DC. The library was founded by Henry Clay Folger and his wife, Emily, and contains the world's largest collection of first folio editions of Shakespeare's plays as well as an impressive collection of other 16th and 17th century material.

The Folger Library copy of 'The Herball'

The book (STC 11750 copy 6) is one of six copies of Gerard's 'Herball' in the library's collection. It contains nearly 1400 pages, plus indices and numerous woodblock illustrations. All but one of these illustrations have been hand coloured and 792 pages, or nearly 60%, of the total have annotations, often many on each page. From examining these annotations it is apparent that they are the work of more than one person: perhaps as many as five people have been involved (see front cover).

The identity of only one of these people is known for certain. This is Richard Whitaker, bookseller and publisher, who had married Joyce Norton. She was the widow of John Norton who had published the first edition of the Herball in 1597. To the rear of the volume is the inscription: "Decemb the 3d 1632 Memorand. I doe warrant this bee the last impression Perfect and if Mr. Capell please to change it for one of the new impression when it cometh out he giving mee twenty shillings and this Booke I doe promise to take it agayne if it be so well condition as now witness my hand and yeare above written Richard Whittaker"

Mr Capell was Arthur Capel (1608-1649), later first Baron Capel of Hadham. He did keep the book, but not for long: he was executed on orders of parliament in 1649. His son, another

Arthur (1631-1683), was created Earl of Essex by Charles II and committed suicide before being brought to trial for treason. The book was inherited by successive generations of the family until the 20th century.

The other annotations can be grouped into several different categories, some of which are illustrated on the front cover:

(i) Many of the illustrations have a code of up to four small circles or half-circles beside them. The initials P and T also appear by some of the text and illustrations. The meaning of these remains unclear.

(ii) Beside many of the woodblocks there are details of colours ('white' & 'yellow') and flowering times ('May' & 'June'). I do not think these were instructions for the colourist but rather were an aid for identification. Instead of having to read paragraphs of description the annotations simplified the identification of the plant specimen. If this is correct then these annotations pre-date the colouring of the illustrations.

(iii) Some of the annotations are simply corrections of printing errors: whether page or illustration numbering.

(iv) For each plant featured in the book the text was broken down into a number of different sections. There was a description of the plant ('the kindes'), the place where it grows, the time of flowering, other names or synonyms, as well as its medicinal properties. The latter was divided into further subsections: the 'temperature' addressed whether the plant had a heating or cooling effect, the 'vertues' covered the illnesses it could be used to treat. Then there were the 'correction' or the antidote. For example 'those who have eaten of the common medow Saffron must drinke the milke of a cow, or els death presently ensueth' (p.31). Some of the annotations simply state "Dangerous" or summarise the text with 'flegme', 'women' & 'toothach' (p.190). This may suggest that the book had belonged at one point to an apothecary, physician or surgeon and that this was before the book passed to the Capel family in 1632.

(v) Throughout the text there are some cross references to earlier European herbals, including Lonicer (1528-1586), Mathiolus (1501-1577) and Dodoens (1517-1585). The handwriting is very distinct and does not match any of the previous categories. The references suggest access to an extensive library of other botanical works and an ability to read Latin.

(vi) There are a small number of the annotations which record critical comments about the text. "P there be some of these sowthistles not described" (p.230) suggests that Gerard's description was not complete. Others include "this figure is wanting" (p.1185) and for Lancashire asphodill "the roote is not a bulbe" (p.88).

(vii) "Thos Hasket" appears in the margins against all those plants which Master Hesketh had supplied to Gerard. Perhaps, like the flower colours these are simply markers in the text for plants to be found in the Lancashire area as well as those in the environs of Ingleborough.

(viii) On p.1329 there is the following entry relating to the Prickly Indian Fig tree "in Mr Parkinson's gardin at the signe of the goulden morter on Ludgat Hill". This was where Parkinson and his family lived and where he had his shop. Later he established another larger garden at Long Acre, sometime between 1607 and 1622 [Burnby, 1994 & DNB]. This

establishes a range from 1597 to 1622 for the annotator's visit to London. Against the text for the Wayfaring tree (p.1305) there is "in Mr Heskets gard" which makes a clear connection between the anonymous annotator and the Clitheroe surgeon.

(ix) At the rear of the volume there are some annotations to the initial pages of the first index but a separate index has also been created which refers to the use of plants for other than medical purposes. Entries include: "Gum Arabicke, Bird lime, Black of Smoke, Larch Resin falsly called Turpentine & Masticke".

The final group of entries relate to the location of plants in the north of England. Some of these simply repeat what had already been printed in the text. There is one of particular interest which relates to the 'broad leaved heath with red berries' (p.1199). Although the text refers to Crosbie Ravenwaith it also states that Gerard had received berries from Master James Thwaites. I have been unable to discover anything about him apart from him being from Unerigg Hall in Cumbria (Jeffers, 1967). However, there are other marginalia which appear to be the earliest records of particular plants in our region. Table 1 is a summary of these with some clarification of the localities. It was these annotations that led the auctioneers to conclude that they were written by Thomasine Tunstall as the only known candidate to be working in the area at the start of the 16th century. So were they correct? Although there is no signature to provide conclusive proof perhaps there are some other clues in the historical records.

Thomasine Tunstall

The earliest printed references to her appeared in two works by John Parkinson. Born in Lancashire he was apprenticed to an apothecary in London at the age of 14 years. He was to serve as apothecary to James I and was later to be appointed as Royal Botanist to Charles I. Parkinson's first book, published in 1629, was 'Paradisi in Sole Paradisus Terrestris' or 'Park-in sun's terrestrial paradise'. He acknowledged plants sent to him by Thomasine Tunstall of the Lady's Slipper Orchid (p.348) as well as the Roseroot (p.348) and Cuckoo Flower (p.389). In his second work, 'Theatrum Botanicum' (Parkinson, 1640), he recorded that Tunstall had supplied him with Scurvy Grass (p.286). Parkinson provided few details about her apart from the description that she was a gentlewoman and lived at 'Bull-banke, neare Hornby Castle'.

In his history of the parish of Tunstall, Chippindall (1940) recorded that Thomasine was baptised on 18th March 1604/5, daughter of Alice Tunstall and her third cousin William Tunstall. Alice was daughter of Francis Tunstall of Thurland Castle and William was from Aldcliffe, on the periphery of Lancaster. They had a total of eight children: Cuthbert, Margaret, Matthew, Thomasine, Katherine, John, Brian and Alice. Unfortunately parish registers for deaths and marriages have yielded no further clues. The Lay Subsidy of 29th April 1626 recorded a 'Thomazin Tonnstalle' living in the parish of Burrow with Burrowe and paying 8d (Chippindall, *loc. cit.*).

In 1629 the recusants of the northern counties were summoned by Charles I's commissioners to appear at York. At the time legislation allowed for the sequestration by the Crown of 2/3 of the estate of all those catholics who refused to conform to the established religion. Rather than forfeit their estates they were given the option of paying fines which ranged from 1/4 to 1/10 of the annual rental value of their estates. Thomasine Tunstall of Fairthwaite was fined £2 10s 0d. An Alice Clopton, possibly Thomasine's younger sister, also lived at Fairthwaite and was fined a similar amount (Brownbill, 1908). In Table 1 'fairtwhete parke' belonging to 'thurslande

castle' were annotations for the site of Moonwort. This suggests that Thomasine Tunstall was the source of at least some of the annotations and the majority of the plant localities.

Though 1629 was the last date that she appeared in official records it is likely that she lived beyond this. The record for Scurvy Grass supplied to Parkinson did not appear in his 1629 book but did make it to the 'Theatrum Botanicum' in 1640.

The plant localities fall into several distinct groups. The largest is those plants found in the Yorkshire Dales: all but one of the fourteen plants were located less than five miles from Thomasine Tunstall's homes at Bull Bank and Fairthwaite Park. The exception was the helleborine (p.324) found between Wensleydale and Swaledale about twenty miles away. The Lancashire and Cumbria locations are more distant and form distinct clusters. There is Arnside, Witherslack and Warton crag which were between 15 and 20 miles from her home; and Crosby and Rosgill near Shap about 20 miles away. Apart from Pendle, which provided a couple of records, all the others are single localities ranging from 10 to over 40 miles away. Clearly her plant hunting was not confined to the immediate vicinity of her home and she possibly travelled more widely to visit relatives or friends.

Discussion

Most of us do not write in books and it is unusual to find a volume with so many annotations contributed by several people. With a lack of dates and definitive identification of the people involved any analysis must be speculative. It is plausible that Thomasine Tunstall at some point owned the book. The localities and the particular reference to a place she is known to have lived is the main evidence to support this. However, she was not born until after the publication of the book in 1597, which suggests that there was at least one previous owner. Could this have been Thomas Hesketh?

He had contributed many records to Gerard, as is acknowledged in the text of the 'Herball'. They were both friends and colleagues and there is evidence that Hesketh visited Gerard in London and that the latter had also travelled to Lancashire (Jeffers, *loc. cit.*). Perhaps the author had given Hesketh a copy of the book in recognition of his contributions and friendship.

There seems to be a link between Tunstall and Hesketh. One annotation suggests that the writer had visited Martholme (p.168), home of Hesketh's mother, and had also been to Hesketh's garden (p.1305). There are also numerous annotations of 'Thos Hesket' against plants which, according to the text, he had supplied to Gerard. The annotations perhaps highlight plants to be found in Lancashire. Finally, both Hesketh and Tunstall were known recusants and part of an extended catholic network amongst the Lancashire gentry. However, Tunstall was only ten years old when Hesketh died in 1613.

Of course this is speculation and there could be alternative explanations which provide a better match. The annotations suggest that at least one of the owners had knowledge of medicine, had access to early European botanical books and knowledge of Latin in which they had been written, had enough practical botanical knowledge to criticise some of Gerard's descriptions, had an interest in the non-medical use of plants and had collected extensively in the north-west of England. There is also the anonymous colourist who had transformed the illustrations and so added to the attractiveness of the book.

Despite the uncertainties about the various people who had added their notes to the book and why they had done so, it does contain many early records of plants found in the north-west of England. There were fifteen plants described by Gerard as growing in the north-west of England, of which ten were directly linked to Thomas Hesketh. In addition, a further twenty four plants (Appendix, Table 1) appear as annotations. This provides a significant increase in the number of plants known to have existed here about four hundred years ago. It is not a complete flora of the area and consists of a mixture of common plants (for example Hart's Tongue) as well as ones which are rare or extinct (for example, the Lady's Slipper Orchid). Perhaps other annotated works exist which may provide additional records of the flora of the 16th and early 17th centuries in our area and enable comparisons with existing plant distributions.

Conclusion

The annotated 'Herball' contains a wealth of material written by several people, only one of whom can be identified with certainty. Whilst the meaning of some of the notations remain obscure it is reasonable to conclude that one or more of the anonymous writers had access to earlier botanical works, had knowledge of medicine, was interested in the non-medical use of plants, had expertise to correct some of Gerard's errors, and lived in the north-west of England. It is possible that the book had been owned by Thomas Hesketh and that it had later belonged to Thomasine Tunstall.

Acknowledgements

I am grateful to Richard Selby for contacting me about the herbal and recognising the importance of such a rare work. Also to the Folger Shakespeare Library, Washington D.C., for facilitating my examination of the 'Herball' and for permission to publish the illustration.

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Appendix

Table 1. The location of annotated plant localities

Herball page no.	Plant name	Location	Notes
27	Water gladiole	Arnsheade	Flowering rush, Arnside
168	Ladie traces	Matholme	Autumn Lady's-tresses, Martholme, Great Harwood

324	Round leafed scurvie grasse	It groweth plentifully by a little brouck betwixt wensladale & swadell: allso in the Lund holmesse by the waterside	Wensleydale & Swaledale
327	Adders toong	In a bankside above Burton in lounsdayle eastward near the river Greetow	Burton in Lonsdale, Greta river, Ingleton
329	Moonwort	It groweth in fairtwete parke belonging ...to thurslande castle in Lunsedaile	Fairthwaite Park
332	Lilly of the valley	In clapdale & in the helkes by Thornton hall	Clapdale, Clapham & Helkes, Ingleton
358	Helleborine flore albo	Growth in the helkes neareh Thornton hall in Lunesdaile	
359	Lady's slipper	It groweth in the Helkes neare Thornton hall in Lunsedaile	
426	Rosewoort	It groweth upon the verie Clyffes in [the] middle of the brow on the northe side of Ingletowne hill	The text refers to Ingleborough
690	Sea bindweede	It groweth by the sea right over against sande scale in fornes and in waonay	Furness & Isle of Walney
756	Sweete smelling Salomans Seale	In clapdale	Polygonatum odoratum
918	Mountaine spikenard	In crage close & on Ingleborow felles at the foote of the hill	Common Valerian
976	Harts toong	On Ingloborough ... in the Helkes	
1000	Sea Hollie	At Coccoromme Aabbay	Cockerham Priory, south of Glasson
1056	Horse shooe	It groweth on the west side of Warton cragge	Horseshoe Vetch, Warton south of Silverdale
1081	Wilde poppie	Leylande & place called Roughfoorde not far from Latham	Annotation corrects Gerard's error of identifying the plant as the 'great Holland Rose'
1091	Raspis	It is found in everie hedge in Loosdale	Raspberry, Lunesdale
1091	Stone bramble	In clapdale & in the Helkes	
1132	English dwarf broom	About Grassyard neare to wharmore parke	Quernmore Park?
1168	Mistletoe	In Arnsheade & weitherslacke & Throwborrow	Witherslack
1189	Juniper	At wetherslacke	
1284	Spindle tree	In the Helkes woode	
1305	Wayfaring tree	In Mr Heskets gard[en] and in Kent plentifully	
1322	Birds cherrie tree	Heggdale Rosgill	Hegdale, nw of Rosgill

Aquatic plants in the Driffield Navigation, East Yorkshire

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Introduction

The upstream, non-tidal, part of the Driffield Navigation in East Yorkshire includes both canal and river sections. The system is largely spring fed from beneath the chalk of the Yorkshire Wolds, has clear calcareous water and, although enriched by inorganic plant nutrients, is generally free from obvious visual pollution. Frequently there are wide margins of emergent plants, while the bed of the channel can often be seen to have a virtually complete cover of submerged plants. Indeed, the plants are so luxuriant that weed cutting and removal are needed to facilitate water flow and drainage, and to benefit navigation.

The main line of the Navigation runs for c.11km from Riverhead at Driffield roughly south-eastwards to the tidal limit at Struncheon Hill Lock. The initial c.8km from Riverhead is the Driffield Canal which has four locks and was opened in 1770 (Duckham, 1972). The canal joins Frodingham Beck and the waterway becomes a sinuous river navigation. After a further c.1km, Frodingham Beck joins West Beck and the waterway, now the River Hull, continues for c.2km to Struncheon Hill Lock. The most downstream c.1.25km of the river navigation is a straight, artificial channel, which was excavated in the first few years of the 19th century (Duckham, 1972). The navigable rivers are at a higher level than the surrounding land, local run-off being carried by low-level drains (Sheppard, 1958). The river navigation is open to boat traffic and is much used by leisure craft. Commercial navigation along the canal ceased in the 1940s and the infrastructure became derelict. More recently, the locks have been restored to facilitate leisure navigation, although the canal remains obstructed by farm bridges and a fixed road bridge at Wansford, c.4.2km downstream of Riverhead.

The luxuriant aquatic vegetation reflects the high availability of inorganic plant nutrients. Nitrate concentrations are high in the feed water, because of fertilizer use in the largely agricultural catchment, while an increase in phosphate has been related to the discharge of treated sewage effluent at Driffield, immediately downstream of Town Lock (e.g. Carr & Goulder, 1990; Kang & Goulder, 1996; Goulder, 2003). Effluent quality improved c.1997 following replacement of percolating filters with activated-sludge plant at Driffield sewage treatment works (Westoll, 1999). Nevertheless, nutrients in the canal remained relatively high; data from the Environment Agency for the canal at Whinhill Lock over 2006 showed a mean NO_3-N of 8.2 (range 5.8-9.6) mg l^{-1} from 12 samples at monthly intervals, and a mean PO_4-P of 216 (range 54-419) µg l^{-1}.

The aims of this study were: (1) to describe water plants and aquatic vegetation in the Driffield Navigation; (2) to explore change in water plants over several decades past.

Water plants in the Driffield Navigation

Aquatic plants were recorded along the Navigation between Riverhead at Driffield and Struncheon Hill Lock. For this the waterway was divided into eight lengths (Table 1 p127). These were bounded by topographical features, usually locks or bridges, and were of unequal length (0.5-2.0km, mean 1.3km).

The water plants in each length were identified and their abundance was estimated. Mostly the underwater plants were visible through transparent water; plants for identification were retrieved using a grapnel or an extensible walking pole fitted with a hook at its end. Emergent plants along the far side of the channel were identified using binoculars. Some submerged plants may have been missed, especially when choppy water and reflected light hindered underwater vision. Checklists published by the Joint Nature Conservation Committee to aid recording in canals (JNCC, 2005) were used; these feature 146 native aquatic plants and 17 non-native aquatic plants that have been recorded from, or possibly occur in, UK canals. Plant nomenclature follows Stace (2019); scientific names are given in the text only if they do not occur in the tables.

The abundance of plants in each length was estimated using a three-point scale; i.e. dominant/abundant (d/a), frequent (f), or occasional/rare (o/r). Very approximately, these values corresponded to the three-point scale used by Holmes (1983) for recording plants in rivers; i.e. d/a=>5% whole-channel cover, f=0.1-5% cover, and o/r=<0.1% cover (Goulder, 2019).

Table 1. Lengths of the Driffield Navigation in which plants were recorded in summer 2018.

1. Riverhead (Grid Ref. TA028573) to Town Lock	c.0.5km
2. Town Lock to Whinhill Lock	c.2.0km
3. Whinhill Lock to Wansford Lock	c.1.5km
4. Snakeholme Lock to Brigham Bridge	c.2.0km
5. Brigham Bridge to the confluence with Frodingham Beck	c.1.1km
6. Frodingham Beck to its confluence with West Beck (R. Hull)	c.1.1km
7. R.Hull from Frodingham Beck/West Beck confluence to Bethell's Bridge	c.0.9km
8. R.Hull from Bethell's Bridge to Struncheon Hill Lock, Hempholme	c.1.2km

Lengths 1-5 are canal sites; Lengths 6-8 are river sites.

Recording was between late May and late September 2018. Lengths 1, 2 and 5 (Table 1) were surveyed twice and when the scores for a plant differed the higher value was used. Although Length 4, from Snakeholme Lock to Brigham Bridge was c.2.0km, only the most downstream c.0.75km were recorded because of lack of footpath access. Observation from a distance suggested that this led to under-recording of Common Reed in this length. In addition, the c.0.9km of canal between Wansford Lock and Snakeholme Lock was not surveyed because of its inaccessibility. To help the interpretation of results the water plants were recorded as (1) submerged and floating-leaved plants and (2) emergent plants. This distinction is sometimes arbitrary; some of the plants found can occupy either category depending upon time of year, depth of water and/or current velocity; examples of these are Unbranched Bur-reed and Flowering-rush.

Altogether, 40 water plants were recorded, 18 submerged/floating-leaved plants and 22 emergent plants (Table 2 p128). Clearly the waterway is rich in aquatic plants but only a few were ever dominant or abundant. Amongst submerged and floating-leaved plants, Water-starwort, Nuttall's Waterweed, Shining Pondweed, Stream Water-crowfoot, and Unbranched Bur-reed were dominant/abundant in one or more lengths. Much the most abundant emergent plant was Reed Sweet-grass. Also dominant/abundant in one or more lengths were Fool's-water-cress, Flowering-rush, Water-cress, and Reed Canary-grass.

Table 2. Aquatic plants in the Driffield Navigation in 2018

	Length							
	1	2	3	4	5	6	7	8
Submerged and floating-leaved plants								
Callitriche sp. Water-starwort	d/a	d/a	d/a	d/a	d/a	o/r	o/r	o/r
Ceratophyllum demersum Rigid Hornwort	0	0	0	0	0	0	o/r	0
Elodea canadensis Canadian Waterweed	0	0	0	o/r	o/r	o/r	o/r	o/r
Elodea nuttallii Nuttall's Waterweed	d/a	d/a	o/r	d/a	d/a	d/a	f	f
Fontinalis antipyretica Greater Water-moss	f	0	0	0	o/r	0	o/r	o/r
Hippuris vulgaris Mare's-tail	0	0	0	0	f	f	o/r	o/r
Lemna minor Common Duckweed	0	f	o/r	f	f	f	f	f
Lemna trisulca Ivy-leaved Duckweed	0	0	0	o/r	o/r	0	o/r	o/r
Myriophyllum spicatum Spiked Water-milfoil	0	0	0	0	0	o/r	o/r	o/r
Nuphar lutea Yellow Water-lily	0	0	0	0	0	0	f	o/r
Oenanthe fluviatilis River Water-dropwort	0	0	0	0	0	0	f	f
Potamogeton crispus Curled Pondweed	o/r	o/r	0	0	o/r	0	0	o/r
Potamogeton lucens Shining Pondweed	0	0	0	0	f	d/a	d/a	f
Ranunculus circinatus Fan-leaved Water-crowfoot	0	0	0	o/r	o/r	0	o/r	o/r
Ranunculus penicillatus pseudofluitans Stream Water-crowfoot	o/r	0	d/a	0	o/r	o/r	o/r	o/r
Sagittaria sagittifolia Arrowhead	0	0	0	0	o/r	o/r	o/r	f
Sparganium emersum Unbranched Bur-reed	0	0	0	d/a	d/a	d/a	d/a	d/a
Stuckenia pectinata Fennel Pondweed	0	0	0	o/r	o/r	0	o/r	o/r
n of submerged and floating-leaved plants	5	4	4	8	14	10	17	17
Emergent plants								
Agrostis stolonifera Creeping Bent	o/r	o/r	0	o/r	o/r	o/r	o/r	o/r
Berula erecta Lesser Water-parsnip	0	o/r	o/r	0	o/r	f	f	o/r
Butomus umbellatus Flowering-rush	0	0	0	0	0	d/a*	f	o/r
Carex acutiformis Lesser Pond-sedge	0	0	0	o/r	o/r	o/r	0	o/r
Carex riparia Greater Pond-sedge	0	o/r	o/r	0	o/r	o/r	0	o/r
Equisetum palustre Marsh Horsetail	0	o/r	0	0	0	0	0	0
Glyceria fluitans Floating Sweet-grass	0	0	0	0	0	0	o/r	0
Glyceria maxima Reed Sweet-grass	0	d/a	d/a	d/a	d/a	d/a	d/a	d/a
Helosciadium nodiflorum Fool's-water-cress	o/r	d/a	f	o/r	f	f	f	o/r
Iris pseudacorus Yellow Iris	0	0	o/r	o/r	o/r	0	o/r	o/r
Juncus effusus Soft-rush	0	0	0	0	0	o/r	o/r	o/r
Mentha aquatica Water Mint	f	o/r	o/r	o/r	0	0	o/r	o/r
Myosotis scorpioides Water Forget-me-not	o/r	f	o/r	o/r	f	f	f	o/r
Nasturtium officinale Water-cress	f	d/a	f	d/a	d/a	d/a	d/a	f
Persicaria amphibia Amphibious Bistort	0	0	0	0	0	0	o/r	o/r
Phalaris arundinacea Reed Canary-grass	0	f	o/r	o/r	f	f	d/a	f
Phragmites australis Common Reed	0	f	0	f	0	0	0	o/r

Ranunculus sceleratus Celery-leaved Buttercup	0	0	0	0	o/r	0	o/r	0
Solanum dulcamara Bittersweet	0	f	f	o/r	f	o/r	o/r	f
Sparganium erectum Branched Bur-reed	0	0	0	o/r	o/r	o/r	o/r	o/r
Veronica anagallis-aquatica Blue Water-speedwell	0	0	0	0	o/r	0	0	0
Veronica beccabunga Brooklime	0	o/r	0	0	o/r	f	f	0
n of emergent plants	5	13	10	12	15	14	17	17
Total *n* of plants	10	17	14	20	29	24	34	34

d/a (infilled) = dominant or abundant, f = frequent, o/r = occasional or rare, 0 = not recorded.
*Includes many submerged plants.

Figure 1. The Driffield Canal at Riverhead, Driffield, May 2018. The sheer masonry margins exclude emergent water plants; the floating and submerged vegetation is largely Water-starwort. *R. Goulder*

Figure 2. The Driffield Canal between Town Lock and Whinhill Lock, May 2018. The waterway has the appearance of a canalised calcareous river; the wide margins of emergent vegetation are Reed Sweet-grass, the submerged beds are Water-starwort. *R. Goulder*

The aquatic vegetation varied considerably along the waterway. There was appreciable water flow along the Driffield Canal (Lengths 1-5) during the survey period and this c.8km of waterway had the appearance of a canalised calcareous river (Figures 1,2 p129). The water was transparent, depth varied between about 0.5m and 1.5m, and there was conspicuous submerged vegetation, often beds of Water-starwort. In places, shading by trees inhibited submerged vegetation, and bankside trees and shrubs hindered access to the waterside. Submerged Nuttall's Waterweed was also abundant while the trailing underwater leaves of Unbranched Bur-reed were conspicuous between Brigham Bridge and Frodingham Beck. Stream Water-crowfoot was abundant approaching Wansford Lock (Length 3), and submerged stands of Mare's-tail were a notable feature between Brigham Bridge and Frodingham Beck. The emergent vegetation along the canal margins, downstream of Town Lock, was extensive and was largely Reed Sweet-grass, although there were also substantial beds of Water-cress (and sometimes Fool's-water-cress) especially between Town Lock and Whinhill Lock (Length 2) and between Brigham Bridge and Frodingham Beck (length 5).

The c.1.1km of the Navigation that is Frodingham Beck (Figure 3 p132) is sinuous river with appreciable flow and relatively shallow water, probably mostly <1.5m. Nuttall's Waterweed and Unbranched Bur-reed continued to be important components of its abundant submerged vegetation. There were also extensive beds of Shining Pondweed, that in places reached and trailed along the water surface. Also notable were submerged beds of Mare's-tail and trailing underwater leaves of Flowering-rush – which here was neither emergent nor flowering. Frodingham Beck usually had 2-4m wide margins of Reed Sweet-grass beyond which there were often emergent beds of Water-cress and Fool's-water-cress.

The c.2km of river navigation from the confluence of West Beck and Frodingham Beck to Struncheon Hill Lock is deep and wide (Figure 4 p132); width c.27m upstream of Bethell's Bridge and c.17m downstream, with depth certainly in places as much as 2m, and with appreciable flow. There are many landing stages with moored leisure boats and a weed-cutting boat had been recently operational when I visited in July 2018. The luxuriant underwater vegetation, visible through transparent water, was dominated by Unbranched Bur-reed and Shining Pondweed. Other frequent submerged/floating-leaved plants were Nuttall's Waterweed, Common Duckweed, Yellow Water-lily and the submerged ribbon-leaved form of Arrowhead. Especially notable were underwater beds of River Water-dropwort, a plant that is regionally rare (Middleton & Cook, 2015). The river also had much marginal vegetation which was dominated by Reed Sweet-grass; other conspicuous emergent plants were Fool's-water-cress, Lesser Water-parsnip, Flowering-rush, Water Forget-me-not, Water-cress, Reed Canary-grass, Bittersweet and Brooklime.

The diversity of aquatic plants tended to increase along the Navigation with distance downstream and was greater in river lengths than in canal lengths (Table 2 p128). The mean number of submerged and floating-leaved plants per canal length was 7.0 (range 4-14) which contrasts with the mean of 14.7 (10-17) for river lengths. Similarly, the mean number of emergent plants in canal lengths equalled 11.0 (5-15) compared with 16.0 (14-17) in river lengths. Overall, the mean number of water plants per canal length was 18.0 (range 10-29) compared to 30.7 (24-34) for river lengths.

Parts of the Navigation are bordered by pasture. Reed Sweet-grass is palatable and marginal stands are grazed and trampled by cattle. This has led to a more open and varied habitat that tends to support greater plant diversity than untrampled margin. This was seen along the west side of the canal between Brigham Bridge and Frodingham Beck (Length 5), along the west side of Frodingham Beck (Length 6) and along the east side of the River Hull upstream of Bethell's Bridge (Length 7). Table 3 shows the plants found in the 2-4m wide, cattle-poached, Reed Sweet-grass margin, alongside the River Hull at c.200m north of Bethell's Bridge.

Table 3. Aquatic and wetland plants in cattle-poached margin on the east side of the River Hull, c.200m north of Bethell's Bridge, July 2018.

Aquatic plants	**Wetland and riparian plants**
Agrostis stolonifera Creeping Bent	*Epilobium hirsutum* Great Willowherb
Berula erecta Lesser Water-parsnip	*Erythranthe guttata* agg. Monkeyflower
Callitriche sp. Water-starwort	*Juncus inflexus* Hard Rush
Glyceria fluitans Floating Sweet-grass	*Stachys palustris* Marsh Woundwort
Glyceria maxima Reed Sweet-grass	
Juncus effusus Soft-rush	
Mentha aquatica Water Mint	
Myosotis scorpioides Water Forget-me-not	
Nasturtium officinale Water-cress	
Phalaris arundinacea Reed Canary-grass	
Ranunculus sceleratus Celery-leaved Buttercup	
Veronica beccabunga Brooklime	

Also encountered alongside the Navigation were wetland and riparian plants, often amongst emergent vegetation, which do not feature on the JNCC checklists of aquatic plants. Great Willowherb *Epilobium hirsutum*, Meadowsweet *Filipendula ulmaria*, Hard Rush *Juncus inflexus* and Water Figwort *Scrophularia auriculata* were found along all or most lengths. The invasive Indian Balsam *Impatiens glandulifera* was recorded in three lengths while the showy red and yellow flowers of Monkeyflower *Erythranthe guttata* agg. were a feature of Lengths 6 and 7.

Vegetation change and stability

Driffield Canal

Aquatic plants in the Driffield Canal in 2018 were much the same as found 16 years earlier. In 2002 I recorded plants along five 0.5km lengths between Town Lock and Brigham (Goulder, 2003). Twenty-eight JNCC checklist plants were found; 11 submerged or floating-leaved and 17 emergent. Most of these were still in the canal in 2018. Found in 2002, but not in 2018, were Stonewort (*Chara/Nitella*), Flat-stalked Pondweed *Potamogeton friesii* and Soft-rush. New in 2018, or missed in 2002, were Canadian Waterweed, Ivy-leaved Duckweed, Fan-leaved Water-crowfoot, Stream Water-crowfoot, Arrowhead, Lesser Pond-sedge and Marsh Horsetail. Additionally, I recorded water plants in the canal at Riverhead, Town Lock, Wansford Lock, Whinhill Lock and Brigham Bridge in September 1993, and along c.0.5km downstream of Town Lock in 1994, 1997 and 2000. All the plants found in those years, except Soft-rush, were still in the canal in 2018.

River Hull

Plant records are available that allow assessment of long-term change or stability shown by aquatic vegetation along the c.2.1km of navigable River Hull from the confluence of West Beck and Frodingham Beck to Struncheon Hill Lock (Lengths 7 & 8). In September 1967 Crackles (1968) walked along c.0.4km of the west bank of the canalised river, upstream from Struncheon Hill Lock. She did not describe the entirety of the aquatic vegetation but made comments upon its more interesting features. Only submerged and floating-leaved plants are mentioned, and these are listed in Table 4 opposite. The importance of River Water-dropwort, observed in large patches, here at its most northerly English location, was emphasised. Also, Fennel Pondweed, Shining Pondweed, Stream Water-crowfoot and Opposite-leaved Pondweed were described as abundant, common, frequent or locally frequent. Rigid Hornwort and Arrowhead were uncommon.

Figure 3. The River Hull Valley northwards (upstream) from the confluence of Frodingham Beck and West Beck, July 2018. The watercourse on the right is the sinuous Frodingham Beck, which is the main line of the Navigation, that on the left is West Beck. Both watercourses have margins of Reed Sweet-grass; the pasture between is below river level and drains through a tunnel beneath West Beck into a parallel low-level drain.

Figure 4. The straight, deep and wide artificial channel of the River Hull New Cut; the view southwards (downstream) from Bethell's Bridge towards Struncheon Hill Lock, July 2018. Luxuriant submerged vegetation coexists with leisure boating.

I collected water samples for bacteriological analysis fortnightly at Bethell's Bridge during 1975 and 1976 (Goulder, 1980). Summer conditions during those years were characterised by clear water, the more or less complete colonisation of the riverbed by submerged plants, and marginal vegetation of Reed Sweet-grass. Submerged and floating-leaved plants included Water-starwort, Greater Water-moss, Stream Water-crowfoot, Yellow Water-lily, Common Duckweed and Pondweeds (*Potamogeton*). Floating plant material, cut further upstream, was often drifting downstream. During the 1976 drought, when river flow was barely discernible, the normally submerged plants reached the surface and established a 60-100% surface cover. Yellow Water-lily had floating leaves rather than its underwater cabbage-like leaves which are more typical of the river. The surface vegetation was all much entangled by filamentous algae. Later, water plants were recorded when Bethell's Bridge was visited during field excursions with students from the University of Hull annually in June from 1977 to 1985. I made further records at Bethell's Bridge in September 1993, and again in August 2012 when Richard Middleton, BSBI Recorder for VC 61, South-east Yorkshire, and I visited the waterway in the neighbourhood of Bethell's Bridge and northward to the confluence of West Beck and Frodingham Beck. Also, plants along this stretch were recorded in August 2014 by the author and members of the East Yorkshire Botany Club. Aquatic plants recorded are shown in Table 4.

Table 4. Historic records of water plants for the River Hull from the Frodingam Beck/West Beck confluence to Struncheon Hill Lock.

	1967[1]	1977-85[2]	1993[3]	2012[4]	2014[5]
Submerged and Floating-leaved plants					
Callitriche spp. Water-starworts	0	+	+	+	+
Ceratophylum demersum Rigid Hornwort	+	+	+	+	0
Elodea canadensis/nuttallii Canadian/Nuttall's Waterweed*	0	+	+	+	+
Fontinalis antipyretica Greater Water-moss	0	+	+	0	+
Groenlandia densa Opposite-leaved Pondweed	+	+	0	0	0
Hippuris vulgaris Mare's-tail	0	0	0	0	+
Lemna gibba Fat Duckweed	0	0	0	0	+
Lemna minor Common Duckweed	0	+	+	+	+
Lemna trisulca Ivy-leaved Duckweed	0	0	0	0	+
Myriophyllum spicatum Spiked Water-milfoil	0	+	0	0	0
Nuphar lutea Yellow Water-lily	0	+	+	0	+
Oenanthe fluviatilis River Water-dropwort	+	+	0	+	+
Potamogeton crispus Curled Pondweed	0	+	+	+	0
Potamogeton lucens Shining Pondweed	+	+	+	+	+
Ranunculus penicillatus pseudofluitans Stream Water-crowfoot	+	+	0	+	0
Sagittaria sagittifolia Arrowhead	+	+	0	+	+
Sparganium emersum Unbranched Bur-reed	0	+	+	+	+
Stuckenia pectinata Fennel Pondweed	+	+	0	0	0
Emergent plants					
Agrostis stolonifera Creeping Bent	0	0	0	+	+
Berula erecta Lesser Water-parsnip	0	+	0	+	+
Butomus umbellatus Flowering-rush	0	0	0	+	0

Caltha palustris Marsh-marigold	0	0	0	+	0
Carex riparia Greater Pond-sedge	0	0	0	0	+
Glyceria fluitans Floating Sweet-grass	0	+	0	0	0
Glyceria maxima Reed Sweet-grass	0	+	+	+	+
Helosciadium nodiflorum Fool's-water-cress	0	+	0	+	+
Iris pseudacorus Yellow Iris	0	+	0	+	+
Juncus effusus Soft-rush	0	+	0	0	0
Mentha aquatica Water Mint	0	0	0	+	+
Myosotis scorpioides Water Forget-me-not	0	+	0	+	+
Nasturtium officinale Water-cress	0	+	+	+	+
Persicaria amphibia Amphibious Bistort	0	0	0	+	0
Phalaris arundinacea Reed Canary-grass	0	+	0	+	+
Phragmites australis Common Reed	0	0	0	0	+
Ranunculus sceleratus Celery-leaved Buttercup	0	+	0	0	+
Solanum dulcamara Bittersweet	0	+	0	0	+
Sparganium erectum Branched Bur-reed	0	0	+	+	+
Veronica anagallis-aquatica Blue Water-speedwell	0	0	0	+	0
Veronica beccabunga Brooklime	0	+	0	+	+

(+)=present, (0)=not recorded. *Initially no distinction was made between these Waterweeds; both were recorded in 2012, the 2014 record is for Nuttall's Waterweed.

[1]From records made in September 1967 (Crackles, 1968); only notable plants were recorded along c.0.4km upstream of Struncheon Hill Lock.

[2]The author's records from the neighbourhood of Bethell's Bridge made during annual student field excursions in June 1977-1985.

[3]The author's records from Bethell's Bridge made September 1993.

[4]Records made August 2012 by Richard Middleton and the author from the neighbourhood of Bethell's Bridge and northwards towards the confluence of Frodingham Beck and West Beck. Some of these records may be for Frodingham Church Drain that parallels the river.

[5]The author's records and records made by members of the East Yorkshire Botany Club in August 2014, from the neighbourhood of Bethell's Bridge and northwards to the confluence of Frodingham Beck and West Beck.

In general, the water plants recorded from the confluence of West Beck and Frodingham Beck to Struncheon Hill Lock in 2018 were much the same as over 1967-2014. In all, 39 water plants were found in 1967-2014 (for this purpose Canadian Waterweed *Elodea canadensis* and Nuttall's Waterweed were not separated) (Table 4 above). Amongst the plants recorded in 1967-2014, only four (Opposite-leaved Pondweed, Fat Duckweed, Marsh-marigold and Blue Water-speedwell) were not still there in 2018 (Table 2 p128). Moreover, Blue Water-speedwell, although not found in Lengths 7 or 8 in 2018 was found further upstream in length 5. New finds in 2018 in Lengths 7 & 8 were Fan-leaved Water-crowfoot, Lesser Pond-sedge and Soft-rush.

Discussion

Most of the aquatic plants found in the Navigation in 2018 (Table 2) are not uncommon in VC61 South-east Yorkshire. Only two plants were encountered that feature on the *South-east Yorkshire (VC61) Rare Plant Register* (Middleton & Cook, 2015). The first of these is River Water-dropwort which is regionally rare; the considerable population of this plant in the River Hull is clearly of significant conservation importance. The second is Stream Water-crowfoot.

This plant is typical of the headwaters of the River Hull and is thought to be secure in VC61 although regionally scarce. It has been reported as suffering from eutrophication (Grime *et al.*, 2007) and its local decrease in River Hull headwaters in the 1980s was related to competition with periphytic algae brought about by enrichment by phosphate-rich effluent from fish farms (Goulder & Carr, 1994). Although rare or scarce aquatic plants are not generally a feature of the Navigation, the entirety of its luxuriant aquatic vegetation is nevertheless a valuable conservation resource. Many aquatic plant species were found (40 in all), and their substantial biomass provides food and shelter for a diverse fauna.

Several reasons, not mutually exclusive, may be suggested for the increase in species richness of water plants with distance downstream, from as few as 10 in Length 1 to over 30 in Lengths 7 & 8 (Table 2 p128). (1) Plants may arise from seeds and vegetative fragments brought from upstream; the lengths that are further downstream will receive propagules from a wider range of tributary streams, drains and ditches and so are more likely to have received a greater diversity of plants. (2) Weed cutting in the more-downstream river lengths might promote a more open and diverse habitat. (3) Puddling by cattle alongside the river encouraged diversity of marginal plants. (4) Some records were for loose shoots rather than rooted plants, e.g. Rigid Hornwort was found only as a loose shoot in Length 7; such loose shoots, perhaps originating in tributaries, were more likely to be recorded at the more downstream sites. (5) The most upstream length (Riverhead to Town Lock) has sheer masonry margins that are inimical for emergent plants.

The constancy of plants recorded is encouraging. In the Driffield Canal, only three water plants found in 2002 were not also recorded in 2018. Amongst these, Flat-stalked Pondweed features on the *South-east Yorkshire (VC61) Rare Plant Register* (Middleton & Cook, *loc. cit.*), where it is described as nationally scarce, but regionally secure with more than 10 recent records. It would have easily been missed in 2018. It is in the Pocklington Canal and has colonised Beverley Beck since 2012 (Goulder, 2019). The seven apparently new plants found in the canal in 2018 might well have been missed in 2002, especially because only 2.5km out of the total 8km of canal were surveyed in 2002 (Goulder, 2003). The failure to record Stream Water-crowfoot in 2002 is surprising; it was in 2018, however, found in appreciable quantity only in the approach to Wansford Lock (Length 3). No flowers were found there, and this plant is tricky to identify from vegetative material. A flowering plant was, however, found in Length 5 and its floral anatomy conformed with criteria for Stream Water-crowfoot in Rich & Jermy (1998). It is, however, possible that other species of water-crowfoot were in the canal but not in flower. Stream Water-crowfoot is the dominant water-crowfoot in the River Hull headwaters (Crackles, 1990).

Also encouraging is the constancy of plants recorded in the River Hull between the West Beck/ Frodingham Beck confluence and Struncheon Hill Lock. All but four of the plants that were in the river during 1967-2014 (Table 4, p133) were also found in 2018 (Table 2 p128). Of these missing plants, Opposite-leaved Pondweed and Fat Duckweed are scarce in VC61 (Middleton & Cook, 2015). Of most significance is the loss of Opposite-leaved Pondweed. This plant appears to have declined in East Yorkshire since it was described as frequent in the River Hull Valley by Crackles (1990) and is vulnerable in Britain and much of Europe (Walker, Stroh & Ellis, 2017). It is thought to be a victim of eutrophication, decline in water quality and loss of habitat. Crackles (1968) found this plant in the River Hull within c.400m upstream of Struncheon Hill Lock in 1967 and I found it at Bethell's Bridge in 1980 and 1984, but not since. It was also found by students

from the University of Hull in Driffield Beck, alongside or immediately upstream of Driffield Show Ground, each year in June-July 1975-1977 and 1979-1980 but not in 1981-1983. This plant was widespread in drains in East Yorkshire in 1996 when I found it at 12 out of 35 sites (Goulder, 2000), and it was still in the Beverley & Barmston Drain at Tickton in 2005 (Goulder, 2010). It was also in the Driffield Canal, between Driffield and Wansford, in 1960 (Sledge 1960), together with Curled Pondweed and Fennell Pondweed – both of which were still in the canal in 2018. I was pleased to find Opposite-leaved Pondweed in the Pocklington Canal near to Silburn Lock in June 2019. The reasons for its apparent loss from the River Hull are not known.

Although water plants that are nationally or locally scarce or rare are not a feature of the Driffield Navigation, apart from River Water-dropwort, the aquatic vegetation is species rich and luxuriant and is a valuable botanical conservation resource. It appears that the present management of the Navigation is largely favourable to water plants.

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Yorkshire Auchenorrhyncha - Part 1: Fulgoromorpha (planthoppers) and Cicadomorpha - Cercopoidea (froghoppers)

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Introduction

The Fulgoromorpha and Cicadomorpha are Infraorders within the suborder Auchenorrhyncha of the Hemiptera. They are all phytophagous and although some species cause leaf damage when feeding none are agricultural or horticultural pests in Britain. In Britain there are 90 recorded species representing 4 families of the Fulgoromorpha; at present 66 of these are recorded from Yorkshire. All 10 British Cicadomorpha - Cercopoidea species, representing 2 families, are recorded from Yorkshire. Overall the number of records held by the YNU is insufficient to truly represent current distribution and status.

The following list is the first of four parts which represent all currently recorded Yorkshire Auchenorrhyncha together with associated Vice Counties, statuses, hosts and years for the first and latest records. The host data are indicative only as some overwinter as adults on evergreen plants, shrubs and trees, while continental food plants may differ from British records and some are polyphytophagous. Many species can only be identified by dissection of male specimens. Consequently, where the female cannot be reliably identified or where specimens are unavailable for examination, such records are indicative only and may not have been validated. Several historic records fall into this group.

The status convention is based on: 1 to 9 records = Rare; 10 to 24 = Scarce; 25 to 49 = Uncommon; 50 to 99 = Frequent; 100 to 199 = Common; 200 or more = Very Common.

Common names are used for host plants, with their associated scientific names only appearing at the first instance in this and subsequent parts.

The taxonomy of European planthoppers is relatively well documented for many countries, however there are currently no published unified keys for identification nor a comprehensive checklist of European species. The sources listed in the bibliography below have been used in compiling this paper and would assist in the identification of specimens.

Infraorder: Fulgoromorpha
Superfamily: Fulgoroidea (planthoppers)
Family: CIXIIDAE Spinola, 1839
Subfamily: CIXIINAE Spinola, 1839
Tribe: OECLEINI Muir, 1922
Trigonocranus emmeae Fieber, 1876
VC61, VC63: rare, top soil and leaf litter, 1984-2015.

Tribe: CIXIINI Spinola, 1839
Cixius cambricus China, 1942
VC64, VC65: rare, shrubs on xerothermic hillsides, 1979-1987.
Cixius cunicularius (Linnaeus, 1767)
VC61, VC62, VC63, VC64, VC65: scarce, willows, Hazel *Corylus avellana*, Silver Birch *Betula pendula*, Alder *Alnus glutinosa*, elms, 1960-2003.
Cixius distinguendus Kirschbaum, 1868 (Figure 1 p141)
VC61, VC62, VC63, VC64, VC65: uncommon, Beech *Fagus sylvatica*, oaks, spruces, pines, 1936-2016.
Cixius nervosus (Linnaeus, 1758)
VC61, VC62, VC63, VC64, VC65: common, deciduous shrubs and trees, 1930-2017.
Cixius similis Kirschbaum, 1868
VC61, VC62, VC63, VC64: uncommon, low growing Silver Birch, Alder, pines 1953-2013.
Tachycixius pilosus (Olivier, 1791)
VC61, VC62, VC63, VC64: frequent, Sloe *Prunus spinosa*, oaks, Silver Birch, poplars, 1935-2018.

Family: DELPHACIDAE Leach, 1865
Subfamily: KELISIINAE Wagner, 1963
Anakelisia fasciata (Kirschbaum, 1868)
VC61, VC63: rare, Greater Pond Sedge *Carex riparia*, 1973-2013.
Anakelisia perspicillata (Boheman, 1845)
VC64: rare, sedges, 1958-1984.
Kelisia guttula (Germar, 1818)
VC61, VC62, VC63, VC64: scarce, sedges, 1966-2018.
Kelisia guttulifera (Kirschbaum, 1868)
VC61, VC63: rare, sedges, 2006-2016, two records.
Kelisia pallidula (Boheman, 1847)
VC61: rare, sedges, 1971, single record.
Kelisia punctulum (Kirschbaum, 1868)
VC61, VC62, VC63: rare, sedges, 1922 (*The Naturalist* No.784:162)-1982, three records.
Kelisia sabulicola Wagner, 1952
VC61: rare, sedges, 2007, single record.
Kelisia vittipennis (Sahlberg, 1868)
VC61, VC62, VC63, VC64: uncommon, cottongrasses, 1935-2017.

Subfamily: STENOCRANINAE Wagner, 1963
Stenocranus fuscovittatus (Stål, 1858)
VC63: rare, sedges, 1984-1995, three records.

Stenocranus longipennis (Curtis, 1837)

VC62, VC63, VC64: rare, Greater Tussock Sedge *Carex paniculata*, 1935-1984, three records.

Stenocranus major (Kirschbaum, 1868)

VC61, VC62, VC63, VC64: uncommon, Reed Canary Grass *Phalaris arundinacea*, 1969-2018.

Stenocranus minutus (Fabricius, 1787)

VC61, VC62, VC63, VC64: common, Cocksfoot Grass *Dactylis glomerata*, 1935-2018.

Subfamily: DELPHACINAE Leach, 1865

Acanthodelphax denticauda (Boheman, 1847) (Figure 2 p141)

VC61, VC62, VC63, VC65: rare, Tufted Hair Grass *Deschampsia cespitosa*, 1934-2015, three pre-1956 and two post 2013 records.

Calligypona reyi (Fieber, 1866)

VC63: rare, Common Club Rush *Schoenoplectus lacustris*, 2018, single locality

Chloriona dorsata Edwards 1898

VC61, VC63: scarce, Common Reed *Phragmitis australis*, 1967-2016.

Chloriona glaucescens Fieber, 1866

VC61, VC62, VC63: rare, Common Reed, 1974-2016.

Chloriona smaragdula (Stål, 1853)

VC63, VC64: rare, Common Reed, (*The Naturalist* No.784:162) 1922 (VC64) otherwise 1990-2013 (VC63).

Chloriona unicolor (Herrich-Schaeffer, 1835)

VC61, VC63, VC64: scarce, Common Reed, 1971-2017.

Chloriona vasconica Ribaut, 1934

VC63: rare, Common Reed, 1984-1990.

Conomelas anceps (Germar, 1821)

VC61, VC62, VC63, VC64, VC65: common, rushes, 1933-2018.

Criomorphus albomarginatus Curtis, 1833

VC61, VC62, VC63, VC64, VC65: frequent, Tufted Hair Grass, reed grasses *Calamagrostis* spp., 1938-2018.

Criomorphus moestus (Boheman, 1847)

VC62, VC64: rare, Reed Grass, 1940-1974.

Criomorphus williamsi China, 1939

VC61, VC63: rare, Meadow Grass *Poa* annua, 1983-2000.

Delphacinus mesomelas (Boheman, 1850)

VC61, VC62, VC63, VC64: scarce, fescues, 1963-2018.

Delphacodes capnodes (Scott, 1870)

VC61, VC63: rare, sphagnum, sedges, Tufted Cottongrass *Eriophorum vaginatum*, 1990-2011, three records.

Delphacodes venosus (Germar, 1830)

VC61, VC63, VC64: scarce, grasses, 1982-2018.

Delphax crassicornis (Panzer, 1796)

VC61, VC63: scarce, Common Reed, 1989-2017.

Delphax pulchellus (Curtis, 1833)

VC61, VC62, VC63, VC64: scarce, Common Reed, 1952-2017.

Dicranotropis hamata (Boheman, 1847)

VC61, VC62, VC63, VC64, VC65: frequent, grasses, 1938-2018.

Ditropis pteridis (Spinola, 1839)
VC61, VC62, VC63, VC64: uncommon, Bracken *Pteridium aquilinum*, 1952-2001.
Euconomelas lepidus (Boheman, 1847)
VC62, VC63: rare, Common Spike Rush *Eleocharis palustris*, 1964-2006.
Euides basilinea (Germar, 1821)
VC61, VC62, VC63, VC64: scarce, Common Reed, 1963-2016.
Eurybregma nigrolineata Scott, 1875
VC61, VC63, VC64: frequent, Wild Rye, soft grasses, Cocksfoot Grass, 1960-2014.
Eurysa lineata (Perris, 1857)
VC61, VC63: rare, grasses, 1968-2014.
Florodelphax leptosoma (Flor, 1861)
VC61, VC62, VC63, VC64: scarce, reeds, 1936-2006.
Florodelphax paryphasma (Flor, 1861)
VC64: rare, sedges, 1963, single record.
Hyledelphax elegantulus (Boheman, 1847)
VC61, VC63, VC64: scarce, grasses, 1959-2014.
Javesella discolor (Boheman, 1847)
VC61, VC62, VC63, VC64, VC65: frequent, grasses, 1938-2015.
Javesella dubia (Kirschbaum, 1868)
VC61, VC62, VC63, VC64, VC65: frequent, bent grasses *Agrostis* spp., 1940-2017.
Javesella forcipata (Boheman, 1847)
VC61, VC62, VC63, VC64, VC65: scarce, grasses, 1960-2002.
Javesella obscurella (Boheman, 1847)
VC61, VC63, VC64: scarce, grasses, 1937-2013.
Javesella pellucida (Fabricius, 1794)
VC61, VC62, VC63, VC64: common, grasses, 1934-2018.
Kosswigianella exigua (Boheman, 1849)
VC61, VC62, VC63, VC64: uncommon, fescues, 1974-2018.
Megamelodes lequesnei Wagner, 1963
VC61, VC63: rare, rushes, 2001-2009, 2 records.
Megamelodes quadrimaculatus (Signoret, 1865)
VC63, VC64: rare, grasses, 1959-1989, two records.
Megamelus notula (Germar, 1830)
VC61, VC62, VC63, VC64, VC65: scarce, sedges, 1957-2003.
Muellerianella brevipennis (Boheman, 1847)
VC61, VC62, VC63, VC64: scarce, Tufted Hair Grass, 1979-2018.
Muellerianella extrusa (Scott, 1871)
VC62, VC63: rare, Purple Moor Grass *Molinea caerulea*, 1990-2005, two records.
Muellerianella fairmairei (Perris, 1857)
VC61, VC62, VC63, VC64: scarce, soft grasses, rushes, 1937-2017.
Nothodelphax distincta (Flor, 1861)
VC63, VC64: rare, Tufted Cottongrass, 1980-2005.
Oncodelphax pullula (Boheman, 1852)
VC64: rare, Black Sedge *Carex nigra*, Golden Sedge *Carex elata*, 1979, single record.
Paradelphacodes litoralis (Reuter, 1880)
VC63: rare, Bottle Sedge *Carex rostrata*, spike rushes, Common Reed, 1985, single record.
Paraliburnia adela (Flor, 1861)
VC61, VC63, VC64: rare, Reed Canary Grass, 1979-2015.
Stiroma bicarinata (Herrich-Schaeffer, 1835)

VC61, VC64: rare, Tufted Hair Grass, 1965-1979.

Paraliburnia clypealis (J. Sahlberg, 1871)

VC63: rare, Purple Small Reed *Calamagrostis canescens*, 2014-2015, three records.

Prokelisia marginata (Van Duzee, 1897) (Nearctic species)

VC61: rare, Common Cordgrass *Spartina anglica*, 2015-2016.

Struebingianella lugubrina (Boheman, 1847)

VC61, VC63, VC64: rare, Great Manna Grass *Glyceria maxima*, 1965-2007.

Xanthodelphax straminea (Stål, 1858)

VC63: rare, bent grasses, 1976-2015

Figure 1. CIXIIDAE: the uncommon *Cixius distinguendus* found on oak at Hollicars, Escrick, in August 2016 .

Figure 2. DELPHACIDAE: the rare *Acantho-delphax denticauda* found at Inkle Moor near Thorne in May 2015 by vacuum sampling.

Figure 3. ISSIDAE: the rare *Issus coleop-tratus* found by beating ivy at Roche Abbey, Rotherham, in August 1982.

Figure 4. CERCOPOIDAE: the scarce *Aphrophora salicina* found on willow at Edenthorpe, Doncaster, in June 2017.

Famly: ISSIDAE Spinola, 1839

Issus coleoptratus (Fabricius, 1781) (Figure 3)

VC63, VC65: rare, deciduous trees, overwintering on Ivy *Hedera helix*, Juniper *Juniperus communis* and Yew *Taxus baccata*, 1970-2004.

Infarorder: Cicadomorpha Evans, 1947
Superfamily: Cercopoidea Evans, 1946 (froghoppers)
Family: CERCOPIDAE Leach, 1815

Cercopis vulnerata Illiger in Rossi, 1807

VC61, VC62, VC63, VC64, VC65: very common, tall herbs and grasses, 1952-2018.

Family: APHROPHORIDAE Amyot & Serville, 1843

Aphrophora alni (Fallén, 1805)

VC61, VC62, VC63, VC64, VC65: very common, willows, Silver Birch, Alder, 1922-2018.

Aphrophora major Uhler, 1896

VC63, VC64: rare, willows, 1971-1990.

Aphrophora pectoralis Matsumura, 1903

VC61, VC62, VC63, VC64: scarce, willows, 1959-2006.

Aphrophora salicina (Goeze, 1778) (Figure 4 p141).

VC61, VC63: scarce, willows, 1984-2018.

Neophilaenus campestris (Fallén, 1805)

VC61, VC62, VC63, VC65: uncommon, grasses, 1964-2018.

Neophilaenus exclamationis (Thunberg, 1784)

VC61, VC62, VC63, VC64, VC65: uncommon, Sheeps Fescue *Festuca ovina*, 1956-2018.

Neophilaenus lineatus (Linnaeus, 1758)

VC61, VC62, VC63, VC64, VC65: very common, grasses, 1931-2018.

Philaenus spumarius (Linnaeus, 1758)

VC61, VC62, VC63, VC64, VC65: very common, polyphytophagous, 1922-2018.

Taxonomic Changes since Le Quesne & Payne (1981) and adopted herein:
FULGOROMORPHA

- *Trigonocranus* Fieber, 1875 is now in the Tribe Oecleini.
- *Cixius* Latreille, 1804 and *Tachycixius* W. Wagner, 1939 are now in the Tribe Cixiini.
- *Oliarus panzeri* Löw, 1883 is now *Reptalus quinquecostatus* (Dufour, 1833).
- *Oliarus leporinus* (Linnaeus, 1761) is now *Pentastiridius leporinus* (Linnaeus, 1761).
- The Tribe *Kelisiini* is now the Subfamily Kelisiinae.
- *Kelisia occirega* Remane & Guglielmino, 2002 is new to Britain.
- The Tribe *Stenocranini* is now the Subfamily *Stenocraninae.*
- The Tribes Achorotilini, Delphacini, Stiromini and Criomorphini have been removed and the species placed in the Subfamily Delphacinae.
- *Delphax crassicornis* (Panzer, 1796) is new to Britain.
- *Dicranotropis divergens* Kirschbaum, 1868 is now in the subgenus *Leimonodite* Kirkaldy, 1907 of *Dicranotropis* Fieber, 1866.
- *Euides speciosa* (Boheman, 1845) is now *Euides basilinea* (Germar, 1821).
- *Eurysa douglasi* (Scott, 1870) is now *Eurysanoides douglasi* (Scott, 1870).
- *Eurysella brunnea* (Melichar, 1896) is new to Britain.
- *Muellerianella extrusa* (Scott, 1871) is raised to a valid species (Booij, 1981).
- *Oncodelphax pullulus* (Boheman, 1852) is now *Oncodelphax pullula* (Boheman, 1852).
- *Prokelisia marginata* (Van Duzee, 1897) is new to Britain.
- *Ribautodelphax pallens* (Stål, 1854) is removed from the British list.

- *Struebingianella dalei* (Scott, 1870) is now *Scottianella dalei* (Reuter, 1880).
- *Struebingianella litoralis* (Reuter, 1880) is now *Paradelphacodes litoralis* (Scott,
- 1870).
- *Tyrphdelphax distinctus* (Flor, 1861) is now *Nothodelphax distincta* (Flor, 1861).

CICADOMORPHA - CERCOPOIDEA

- *Aphrophora alpina* Melichar, 1900 is now *Aphrophora major* Uhler, 1896.
- *Aphrophora costalis* Matsumura, 1903 is now *Aphrophora pectoralis* Matsumura, 1903.

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A list of some British species and selected photographs can be viewed at: https://www.britishbugs.org.uk/gallery.html

Additions and corrections to the Yorkshire Diptera list (part 8)

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Introduction

The vast majority of the writer's (AG) fieldwork during the past decade has been by necessity outside Yorkshire's boundaries. There has, however, been much to report on the findings of other workers, of which the county is currently blessed with a number of talented, and sometimes prolific, students of Diptera.

Barry Warrington continues to excel with Agromyzidae and deserves great credit for the very high quality of his work and papers. Barry's recent papers in *Dipterists Digest* Vol. 25 No. 2 (Warrington 2019a, 2019b & 2019c) include a species new to science (*Melanagromyza galegae* Warrington, 2019) and two *Liriomyza* species new to Britain (*L. latigenis* (Hendel, 1920) and *L. yasumatsui* Sasakawa, 1972): all from brownfield land in VC61 Hull. In the same journal, a joint paper (Warrington & von Tschirnhaus, 2019) adds *Liriomyza obliqua* Hendel, 1931 to the British list from Wharram Quarry, which is in VC61, not VC62 as stated in the paper; but nevertheless, in Yorkshire.

An enormous quantity of Diptera records have been received by AG over recent years, and whilst much of what has been received has yet to be fully dealt with due to lack of time, it is astonishing just how many new vice-county (VC) records continue to be made. If fully enumerated, the VC additions for the past decade alone would easily fill an issue of *The Naturalist*. The results of Andy Godfrey's work at Nosterfield Nature Reserve during 2017 and 2018 (lists forwarded by Jill Warwick and Andy) were particularly notable for vice-county additions, with every other species in the lists being new to VC65. Even a study of the small and superficially mundane Fulford Community Orchard (SE609476) by Richard Wilson during 2018 produced an interesting addition to the VC61 list, viz. *Actia pilipennis* (Fallén, 1810) (Tachinidae) det. AG. Additions to the full county list are inevitably becoming less frequent, but continue to occur. Those published in the main list of the current paper have not been previously published elsewhere.

The most extensive Diptera lists received by AG over the past two years were forwarded by Ian Andrews (various families), Gavin Boyd (various families), Joan Childs (Syrphidae), John Coldwell (various families from the Barnsley area), Bill Ely (various families, mainly from the Rotherham area, and including recently-identified 20th Century material), Andy Godfrey (various families from Nosterfield Nature Reserve, plus Terry Whitaker's recent VC64 records), Julian Small (various families, including much *Nematocera*, predominantly from VC61 Wheldrake), Tracy Money (Syrphidae), Barry Warrington (principally Agromyzidae, now published in reports aside from the current paper), and Phillip Whelpdale (various families from Potteric Carr in 2018, identified by DNA analysis). Others who recently forwarded short lists or odd records were: Roy Crossley, Bill Dolling, Jim Jobe, Gill Smith and Derek Whiteley.

During the past year or so, photographs of flies were received from: Pat Bone, Ian McDonald, Ivan Nethercoat, Dave Raffaelli and David Smith. These photographs included several of

the very large and colourful hoverfly *Volucella zonaria* (Poda, 1761) (Syrphidae), which has caused special interest among Yorkshire naturalists generally, since its recorded arrival in the county during 2013. It now appears to be well established in Yorkshire, principally in urban and suburban areas; indeed, AG even found it close to the centre of York in VC62 beside Foss Islands Road (SE6089652036) on 04.08.2018.

Additions and re-instatements to the Yorkshire Diptera list

In the list below, and the list of exclusions which follows, a full surname is given when a person is mentioned once only. Otherwise, the recorders etc. are abbreviated to initials, viz. Ian Andrews (IJA), Joan Childs (JC), Chris Cheetham (CAC), John Coldwell (JDC), Frederick Edwards (FWE), Andy Godfrey (ANRG), Andrew Grayson (AG), Percy Grimshaw (PHG) and Julian Small (JOHS).

LIMONIIDAE

Dicranomyia* (*Dicranomyia*) *affinis (Schummel, 1829) and ***D.* (*D.*) *lutea*** (Meigen, 1804) are re-instated to the Yorkshire list following a taxonomic review of *D.* (*D*) *mitis* (Meigen, 1830) *sensu lato* by Starý & Stubbs (2015), which raised *affinis* and *lutea* to species rank from their former synonymy with *mitis*. Historically, this *Dicranomyia* trio were all recorded from Yorkshire; indeed, they were all added to the Yorkshire list as individual species by Cheetham (1921), the specimens having been determined by FWE. Subsequently, Edwards (1938) relegated *affinis* and *lutea* to varieties of *mitis* and they remained as such until the Starý & Stubbs review. Based on both historic and recent records, *D.* (*D.*) *lutea* and *D.* (*D.*) *mitis* sensu stricto are both common and widely distributed in Yorkshire; whereas, *D.* (*D.*) *affinis* is very local. In time, it is best that Yorkshire records of the aforementioned *Dicranomyia* are re-evaluated based upon re-examination of extant specimens against Starý & Stubbs (2015).

Ormosia* (*Ormosia*) *ruficauda (Zetterstedt, [1838]): VC63: Holme Moor, Marsden (SE0510) 12.06.2013, ANRG.

Phylidorea* (*Phylidorea*) *longicornis (Schummel, 1829) (= *glabricula* (Meigen, 1830)): VC64: Fishponds Wood, Acomb (SE55) 26.05.2004, ANRG. This is a re-instatement to the Yorkshire list. A 1996 record from VC62 Fylingdales (sub nom. *glabricula*) may also have been correct, but the recorder, Geoff J. King, did not retain a specimen and withdrew his record (Grayson, 2005).

KEROPLATIDAE

Macrocera nigricoxa Winnertz, 1863: VC61: Wheldrake Rothamsted Trap (SE690744) 26-27.09.2016 (1), 29-30.09.2016 (3) JOHS.

CERATOPOGONIDAE

Culicoides* (*Oecacta*) *clastrieri Callot, Kremer & Deduit, 1962: VC61: Wheldrake Rothamsted Trap (SE690744) 14.06.2016 (1) JOHS.

Sphaeromias pictus (Meigen, 1818): VC63: New Park Spring (ex colliery site with some flushes and rough grassland) (SE4107) 15.08.2017 (♀) JDC.

CHIRONOMIDAE

Orthocladius* (*Orthocladius*) *glabripennis (Goetghebuer, 1921): VC63: Elsecar Colliery (SE3900) 02.04.2017 (♂) JDC.

STRATIOMYIDAE
Oxycera terminata Wiedemann in Meigen, 1822: VC65: Nosterfield NR (reed-beds) 13.07.2017 (1 specimen ex Malaise trap) ANRG. Further details will be published in a forthcoming paper on the invertebrate fauna of Nosterfield (ANRG, pers. comm.).

SYRPHIDAE
The hoverfly *Dasysyrphus neovenustus* Soszyński, Mielczarek & Tofilski, 2013 is very similar to, but quite distinct from, *D. venustus* (Meigen, 1822), as was correctly recognised by Soszyński *et al.* (2013). It was first recognised from Yorkshire by JC in 2018, which prompted both JC and AG to re-examine their earlier *Dasysyrphus* specimens. This re-examination produced roughly equal numbers of *D. neovenustus* and *D. venustus* sensu stricto; the records being as follows.

Dasysyrphus neovenustus Soszyński, Mielczarek & Tofilski, 2013: VC61: Allerthorpe Common (ride) (SE754477) 27.05.2017 (♀) JC: VC62: Beadale Wood, Wrelton (SE7786) 05.06.2011 (♀) AG; Bridestones trail near car park, Dalby Forest (bank with abundant buttercups *Ranunculus*) (SE877905) 31.05.2018 (2♀) JC; Cawthorne (SE779895) 19.05.1989 (♂) AG; Manor Vale Wood, Kirkbymoorside (SE6987) 25.06.1994 (♀) AG; Wass Bank (SE5680) 18.05.1995 (♂ & ♀) AG; Wykeham Forest (ride in mixed forest) (SE940886) 10.06.2018 (♀) JC.
Dasysyrphus venustus (Meigen, 1822) sensu stricto: VC61: Jeffry Bog (SE7566) 18.05.1991 (♂), 29.05.1993 (♀) AG: VC62: Bridestones trail near car park, Dalby Forest (bank with abundant buttercups) (SE877905) 31.05.2018 (2♀) JC; Duncombe Park (SE6082) 11.06.1994 (♂) AG (formerly misidentified as *D. friuliensis* (van der Goot, 1960)); Kirkdale Woods (riverside meadow) (SE671861) 16.06.2017 (♀) JC; Sutton Bank (SE5281) 06.06.1996 (♀) AG.

TEPHRITIDAE
Tephritis divisa Rondani, 1871: VC61: Easington Dunes (TA4018) 20.07.2018 (1) Derek Whiteley.

LAUXANIIDAE
Sapromyza* (*Sapromyza*) *basalis Zetterstedt, 1847: VC63: Dodworth Tip (SE3105) 22.08.2018 (♂) JDC.

CHAMAEMYIIDAE
Leucopis albipuncta Zetterstedt, 1855: VC63: New Park Spring (SE4107) 29.07.2017 (♂) JDC.

HELEOMYZIDAE
Neoleria ruficauda (Zetterstedt, 1847) has now been confirmed from Yorkshire by IJA and can be re-instated to the county list. IJA's records are: VC61: Allerthorpe Common (SE755480) ex Mallard *Anas platyrhynchos* corpse, 20.12.2018 (♂), 22.12.2018 (♂ & 4♀); Bishop Wilton (SE794546) 28.04.2018 (♂ & 3♀); Calley Heath (SE751498) ex Roe Deer *Capreolus capreolus* corpse, 29.12.2018 (2♂); Millington (SE841529) ex Roe Deer corpse (died 02.04.2017), 08.04.2017 (3♂), 09.04.2017 (2♂), 21.04.2017 (♂); New Covert and Park Wood (SE732442) ex bramble leaf at path edge, 26.12.2018 (♂). *N. ruficauda* was originally added to the Yorkshire list by Skidmore (1968); however, Peter Skidmore was subsequently of the opinion that his *N. ruficauda* records from VC65 High Force (Skidmore, 1968) and VC63 Roche Abbey (unpublished) were more likely to refer to *N. ruficeps* (Zetterstedt, [1838]); and it was on that basis that Grayson (2006) provisionally excluded *N. ruficauda* from the Yorkshire list.

EPHYDRIDAE
Setacera aurata (Stenhammar, 1844): VC61: Calley Heath (SE751498) 03.04.2018 (♂) IJA (teste A. G. Irwin).
Setacera trina Collin, 1964: VC61: Millington (SE841529) 08.04.2018 (♂) IJA.

FANNIIDAE
Fannia norvegica Ringdahl, 1934: VC63: Wickersley Wood (SK483912) 27.05.2005 (♀) W. A. Ely.

MUSCIDAE
Polietes meridionalis Peris & Llorente, 1963: VC61: Buttercrambe (SE737582) 07.06.2018 (♀) IJA.

TACHINIDAE
Catharosia pygmaea (Fallén, 1815): VC63: Woolley Colliery (SE3110) 29.06.2018 (♀), 21.07.2018 (♂), 20.08.2018 (♂ & ♀) JDC.
Cistogaster globosa (Fabricius, 1775): VC63: Cudworth Common (SE4007) 24.07.2018 (♀) JDC; New Park Spring (SE4107) 25.07.2018 (♂ & 2♀) JDC.
Phorocera obscura (Fallén, 1823): VC61: Calley Heath (SE751498) 13.05.2018 (♂) IJA; North Cave Wetlands (SE883328) 20.05.2018 (♂) IJA.

Exclusions from the Yorkshire Diptera list
In the future, it is quite likely that DNA analysis will become standard practice for identifying invertebrate samples, although complete reliability of results will always depend on all material in DNA reference libraries being accurately identified. Any misidentified reference material will inevitably lead to erroneous results, even if DNA analysis technology proves completely infallible, as is likely. Over recent years, AG has received two lists of records produced by DNA analysis methodology, the most recent being forwarded by Phillip Whelpdale in order to initiate a debate on this fascinating and relatively new diagnostic procedure. The list comprised various invertebrates from Malaise trap sampling carried out at VC63 Potteric Carr in 2018. It included three flies which would be new to Yorkshire if the records could be trusted without question; however, given the national rarity of ***Chironomus* (*Chironomus*) *commutatus*** Keyl, 1960 (Chironomidae) and ***Thecocarcelia acutangulata*** (Macquart, 1850) (Tachinidae), and the fact that ***Nephrotoma scalaris*** (Meigen, 1818) (Tipulidae) is not known from Britain, then these records are certainly suspect, and all three species are best provisionally excluded from the county list, pending expert confirmation based on extant material. These species were recently mentioned in an interesting report by Horsfall (2019). There are old published British records of *N. scalaris*, but these were apparently all misidentifications of the nationally Local *N. flavipalpis* (Meigen, 1830).

CERATOPOGONIDAE
Culicoides* (*Oecacta*) *albicans (Winnertz, 1852) requires provisional exclusion from the Yorkshire Diptera list, as the only county record was a tentative identification as "*Culicoides* ?*albicans* Win." by FWE in Cheetham (1927); since when, many more *Culicoides* species have been described. The record in Cheetham (1927) was from VC61 Skipwith Common on 03.07.1926 during a "long week-end" of collecting carried out together by CAC and FWE.

CHIRONOMIDAE

Conchapelopia triannulata (Goetghebuer, 1921) is best provisionally excluded from the Yorkshire list, as there are doubts about the true identity of an alleged male which was collected by FWE "in a bit of woodland by the streamside below Boltby" on 06.07.1926 whilst accompanied by CAC. The Boltby male was named as *Tanypus triannulatus* Goetghebuer by FWE (Cheetham, 1927 & 1927a); however, Goetghebuer (1927) subsequently considered his *T. triannulatus* (now *Conchapelopia triannulata*) to be synonymous with Meigen's *T. pallidulus* (now *C. pallidula*). This application of synonymy caused Goetghebuer's species to be deleted from the British list, and the Boltby record to be transferred to Meigen's *T. pallidulus*. Based on re-examination of material, including British material, Michiels & Spies (2002) correctly restored *C. triannulata* to species rank, and effectively re-instated *C. triannulata* to the British list. This does not however automatically mean that FWE's Boltby record can be trusted to refer to the true *C. triannulata*.

EMPIDIDAE

Rhamphomyia* (*Rhamphomyia*) *albosegmentata Zetterstedt, [1838] was recorded in error from Yorkshire, the specimens being other *Rhamphomyia* species. Falk & Crossley (2005) stated that *R.* (*R.*) *albosegmentata* is recorded widely in Scotland, mainly near streams in hill country above 800 metres, and that the only British records outside Scotland are an unconfirmed 1932 record from Gloucestershire, and two old unauthenticated records from Yorkshire. These old Yorkshire records are in Grimshaw (1907 & 1924). The record in Grimshaw (1907) is from Levisham, 13.05.1895, leg. W.D. Roebuck, det. PHG. The record in Grimshaw (1924), also det. PHG, is from the YNU Ravenscar meeting held between 07 and 09.06.1924. Surprisingly, *R. albosegmentata* is listed within the text of Grimshaw (1924) with no special mention or further comment afforded. The voucher specimens for these PHG records are in The Yorkshire Museum, York, and were re-identified as *R.* (*R.*) *stigmosa* Macquart, 1827 by AG (Grayson, 1994). There are no further *Rhamphomyia* specimens from these localities in PHG's main collection within the National Museums Collection Centre in Edinburgh. PHG's misidentification of *R.* (*R.*) *albosegmentata* from Yorkshire is a mystery, but perhaps unsurprising, as this empid fly was originally incorrectly recorded as British by Verrall (1883), also based upon specimens of *R.* (*R.*) *stigmosa* according to Collin (1961). G.H. Verrall was an outstanding entomologist who became the principal British authority on Diptera of his time; but in Verrall (1883) his opinion on the genus *Rhamphomyia* was that it "remains in a most unsatisfactory state, very few species being as yet well identified or described." Verrall's further comment which begins "The species I have called *R. albosegmentata*" is a clear indication that even he was uncertain about his specimens being agreeable with Zetterstedt's *Rhamphomyza albosegmentata*. There is a further Yorkshire specimen identified as *R.* (*R.*) *albosegmentata* in Leeds Museum Discovery Centre (cabinet 35: drawer 17), but this was re-identified as *R.* (*Pararhamphomyia*) *pilifer* Meigen, 1838 by AG on 30.10.2008. The specimen was originally determined by Mrs. E. C. Broadhead, and was taken by sweeping larch at VC64 Harewood on 08.06.1964. As part of the 'insects on larch' project, it is quite possible that this erroneous record of *R.* (*R.*) *albosegmentata* may have been published.

SYRPHIDAE

Following the results of several decades of fairly intensive hoverfly recording nationally, it is now safe to assume that ***Cheilosia nigripes*** (Meigen, 1822) does not occur in Yorkshire, and that any reference to this species from Yorkshire will be erroneous. The only authentic British *C. nigripes* specimens known to Stubbs & Falk (1983) were from the Chalk districts of southern

England; and that remains basically the case. The distribution map in Ball & Morris (2014) shows all authentic British records are confined below a conceptual line between the River Severn and the River Thames. In light of this, the two VC62 Yorkshire records of *C. nigripes* (sub nom. *Cartosyrphus nigripes*) in Walsh (1956) can be regarded as probable misidentifications; but they may have resulted from misapplication of synonymy, as Walsh (1956) erroneously equated their original *Chilosia* (now *Cheilosia*) *antiqua* (Meigen, 1822) identifications as being synonymous with *C. nigripes*. The statement in Stubbs & Falk (2002) that, according to Roy Crossley, *C. nigripes* had "recently been confirmed from a site in Yorkshire" was incorrect; as Roy (pers. comm. to AG circa 2005) commented that he had not made the statement and had no specimens in his collection. Childs (2019) provides further useful notes on erroneous Yorkshire records and the problems of correctly identifying *C. nigripes* using published keys and literature.

TEPHRITIDAE

Urophora* (*Urophora*) *solstitialis (Linnaeus, 1758) requires confirmation as a Yorkshire insect, as it is likely that all 19th and 20th Century Yorkshire records were misidentifications of other *Urophora* species. It was first mentioned by Mosley (1892) as a flower-head gall on *Centaurea nigra* (Knapweed) at Whitley, near Huddersfield. Adults were bred out from the gall, and named by E. A. Fitch; however, this is an incorrect host association (White, 1988). Given Mosley's description of the gall, the causer would probably be the common *U.* (*U.*) *jaceana* (Hering, 1935), or else the more local *U.* (*U.*) *quadrifasciata* (Meigen, 1826): both occur widely in Yorkshire.

EPHYDRIDAE

Teichomyza fusca Macquart, 1835 was recorded from "washed up seaweeds" at Flamborough on 14.07.1934 by Cheetham (1934) sub nom. "*Tichomyza fusca* Meg." *Tichomyza* is an acceptable previous spelling of the genus, but presumably the typesetter misread 'Mcq.' for 'Meg.' This fly was considered nationally Extinct by Falk *et al.* (2016) who gave the last British locality and latest year as Dover in 1902, and commented "only ever found in Southern Britain". Cheetham's *T. fusca* record may have been correct, but is certainly questionable, and in the absence of voucher material to confirm the record, provisional exclusion from the Yorkshire list is the best approach.

MUSCIDAE

Donald H. Smith identified several specimens he took during 1957 in VC61 at Ferriby and Houghton Woods as ***Hydrotaea tuberculata*** Rondani, 1866. He subsequently gave two specimens to AG, who gave one to The Yorkshire Museum in York (Grayson, 1994). Upon re-examination by AG, the specimen Coll. AG is a female *H. armipes* (Fallén, 1825). The other identifications of *H. tuberculata* are therefore suspect, and are best provisionally discounted.

Acknowledgements

The acknowledgements have already been effectively given in the Introduction. The writer is grateful to all persons mentioned, regardless of whether or not their lists contained any records which are enumerated here.

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A recent increase in observations of species of the lichen genus *Ramalina* in southern Holderness

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I dedicate this note to the memory of Mr Albert Henderson, my friend and mentor in the study of stoneworts and lichens, 1992 - 2016. I feel privileged to have known Albert and to have benefited from his help to identify lichens of the genus *Ramalina*, the subject of the last correspondence between us. His very last words to me were, ".... we are getting there", which I took as encouragement to carry on.

In February 2016 I visited a plantation in Easington (TA3919) where I found a branch of Crack Willow *Salix x fragilis* bearing several tufts of lichen that I tentatively identified as *Ramalina lacera* and *R. farinacea*. In April of the same year I found a Sycamore tree *Acer pseudoplatanus* near Holmpton (TA3522) with more than 20 tufts of putative *R. fastigiata*. In more than 25 years of observing botanical interest in the East Riding of Yorkshire I had seen only a few single occurrences of *R. fastigiata*, so finding three different species over a period of six weeks whetted my appetite for looking for more specimens and for seeking confirmation of my identifications.

Over a period of one month ending 12 May 2016 I examined easily-accessible trees and church walls in five hectads across southern Holderness and, including those mentioned above, collected a total of 24 samples. I tried to identify them as best as I could before sending them to Albert for determination or confirmation. This led to several long telephone conversations which was always an enjoyable feature of working with Albert, and one that I now miss. Albert referred my specimens to Dr C. Hitch and collectively we concluded that there were 11 records for *R. fastigiata*, 8 for *R. farinacea* and 5 for *R. lacera*, one or more of them collected from hectads TA21, TA22, TA24, TA31 and TA32. Some of these specimens were duplicates from the same station.

The plain of Holderness lay in the wake of former coal-fired power stations of which Drax has been converted to use a biomass feedstock and both Ferrybridge and Eggborough plants have closed down. Reduction in these sources of atmospheric pollution by compounds of sulphur favours an upsurge in the occurrence of lichens such as those in the genus Ramalina.

Acknowledgment
I thank Dr Chris Hitch for his help for both determining and confirming the identification of the 24 lichen specimens during 2016 and Professor Mark Seaward for making valuable comments on this note.

YNU Bryological Section: Report for 2018

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Excursions

Two sectional meetings were held in 2018 and are reported below. In addition, the spring meeting of the British Bryological Society was held in Swaledale in April and produced a large number of records, including several of great interest. A report of this meeting has already appeared in *Field Bryology* (Blockeel, 2018).
Nomenclature follows the current British Checklist and Census Catalogue (Hill *et al.*, 2008).

Spring meeting, Anston Stones Wood (VC63), 5 May 2018

Anston Stones is a well-recorded site and the reason for returning was to search for the nationally rare moss *Anomodon longifolius*, which was found there in February 1986 and seen again in September 1991. There was only a single known patch on a large boulder but, since 1991 knowledge of its precise location has been lost. We entered the wood at its eastern end, recording *Gymnostomum calcareum* and *Leiocolea badensis* on the railway bridge. We worked westwards along the north-facing slope and reached the rich crags towards the western part of the wood, known to support *Marchesinia mackaii*, *Cololejeunea rossettiana* and *Conardia compacta*. These are all rare bryophytes with very few localities throughout Yorkshire and all three still occur in good quantity. *Marchesinia* is particularly interesting, being an Atlantic-Mediterranean liverwort having most of its British populations on or near the western coasts, but with a few outlying inland sites in Derbyshire, South Yorkshire and Nottinghamshire. Other calcicole bryophytes that we noted included *Ctenidium molluscum*, *Didymodon sinuosus*, *Distichium capillaceum*, *Fissidens dubius*, *Mnium stellare*, *Neckera complanata*, *N. crispa*, *Plagiomnium cuspidatum*, *Taxiphyllum wissgrillii* and the liverwort *Porella platyphylla*. The moss *Tortula marginata*, which has a southern distribution and has a strong preference in Yorkshire for the Magnesian Limestone, was present in good quantity.

We made our way to the western end of the Wood, where the site for *Anomodon longifolius* was known to have been. When first found there, it was associated with *A. viticulosus*, a more robust and conspicuous moss which is still present in moderate quantity on boulders and crags,

especially on the south-facing rocks north of the stream in the western part of the wood. The distinctive liverwort *Metzgeria pubescens* is also present here. However, in spite of extensive searching, we failed to find *Anomodon longifolius*. Though obviously vulnerable to disturbance and chance events such as tree-fall, it would be premature to conclude that it has been lost from this site and further searches might yet lead to its rediscovery.

At the western edge of the wood where the tree cover is more open we recorded a number of epiphytes that were certainly not present there for most of the 20th century. They included *Frullania dilatata*, *Metzgeria violacea*, *Cryphaea heteromalla*, *Orthotrichum pulchellum*, *O. stramineum* and *Ulota crispula*. In total we recorded 72 species in and near the wood.

Autumn meeting, Nosterfield Nature Reserve (VC65), 13 October 2018

The reserve at Nosterfield is situated in the disused parts of sand and gravel quarries on low-lying land between the R. Ure and the R. Swale. The eastern parts of the quarries are still actively worked. Our recent excursions in VC65 have been in the uplands, so we hoped that the lowland habitats in the Reserve would provide an interesting contrast. We limited our visit to the northern sector of the Reserve, by Nosterfield village. Magnesian Limestone is exposed at its western end and we started our recording there as it was likely to be the most productive area. There are exposures of bare rock with thin soil cover, still only partly vegetated. *Homalothecium lutescens* was locally plentiful. *Aloina aloides* was common, though only partly fertile, but even more exciting was the presence of the closely related and nationally rare *A. brevirostris* on soil over a rock slab. This is a very elusive moss and a very gratifying find. The population in the Reserve appears to be very restricted, but we were not able to scrutinise all the areas of open ground. Other scarce bryophytes in this habitat included *Leiocolea badensis*, *Ditrichum flexicaule* and *Microbryum davallianum*. The list was supplemented by numerous ruderal bryophytes found around the edges of the quarry on paths and disturbed soil, most notably *Tortula modica*. We searched for epiphytes on the trees at the top of the nearby embankment, but mostly they were too immature. Steven Heathcote spotted a single stem of *Syntrichia papillosa* on a cut willow log and we also found very small amounts of *Metzgeria violacea*, *Radula complanata* and *Syntrichia laevipila*.

After lunch we worked the margins of the lakes but bryophytes were rather sparse there. *Drepanocladus aduncus* and *Leptodictyum riparium* were present. However some exposed stony ground at the water's edge in one place produced the most unexpected find of the day, *Bryum knowltonii*, another nationally rare moss (and considered to be critically endangered). All of its few recent records in Britain have been in coastal habitats but there are earlier records from old inland pits, so the new locality fits this historical pattern.

On our return to the car park we added some further species from trees and old walls. *Syntrichia virescens* was found in the base of an Ash tree, and *S. montana* was scattered along the boundary wall. Our final list for the day totalled 61 bryophytes.

The year's records

The number of records received in 2018 from each of the Watsonian vice-counties is shown below.

Vice-county	Records received
61	1
62	31
63	255
64	799
65	3291

The large number of records in VC65 demonstrates the success of the week-long meeting of the British Bryological Society, based at Reeth in Swaledale. During this meeting it was very pleasing to re-discover several long-lost records made by the horticulturist Richard Barnes in the Dale in the late 19th century. Notable among these was the nationally rare and endangered moss *Anomodon longifolius*, recorded by Barnes at Richmond and now re-found at Whitcliffe Wood. This is the only extant site known in the vice-county. Barnes also recorded *Pterogonium gracile* in the Richmond area and this too was re-found, on several boulders on the grassy slopes to the west of Whitcliffe Wood. Its few other Yorkshire localities are confined to the north-western edge of the historic county. Whitcliffe Wood and Scar is a very important bryological site. *Homomallium incurvatum*, another nationally rare moss, was already known to occur there, having been re-discovered in 2006 and still present. During the BBS meeting *Plasteurhynchium striatulum* was added to the list, a new VC record and a slight extension northwards of its range in England (there is a single Scottish locality on the island of Lismore). Other records at Whitcliffe included *Amblystegium confervoides* on stones in the wood and *Weissia longifolia* var. *longifolia* on bare soil (mainly on anthills) in the grassland. Both of these were first VC65 records since the early 20th century. *Cololejeunea minutissima*, a tiny liverwort that has rapidly expanded its range in the past two decades, was found at Hudswell Woods and is now known from all the Yorkshire vice-counties.

Another interesting find from Swaledale was *Encalypta pilifera*. This is closely related to *E. vulgaris* but differs in the presence of a hyaline hair-point at the leaf tip. It has only recently been recognised again as a distinct species and its known distribution is still incomplete. The Swaledale records are the first confirmed for Yorkshire.

The summer drought during 2018 had a marked impact on the bryophytes and there was obvious die-back in parched habitats. On the other hand, the low water-levels in many of our reservoirs let to population explosions of some of the bryophytes that are characteristic of this temporary habitat. Particularly striking was a very large population of the liverwort *Riccia huebeneriana* at Dale Dike Reservoir near Sheffield, a new site for this very scarce plant.

The list below provides details of these and other selected records, including all new vice-county records and updates to the national Census Catalogue (identified by an asterisk). The vice-county is given in brackets before each individual record.

Barbilophozia barbata: (65) SD9199 Muker, Arn Gill area, BBS Meeting, 6 April 2018; (65) SD9198 Ivelet Wood, BBS Meeting, 6 April 2018; (65) NY9700 Old Gang and Mill Gill, Swaledale, BBS Meeting, 8 April 2018; (65) SD8700991673 on wall, Simonstone, near Hawes, Wensleydale, BBS Meeting, 7 April 2018.

Barbilophozia hatcheri: (65) SD9199 Muker, Arn Gill area, BBS Meeting, 6 April 2018; (65) NY9700 Old Gang and Mill Gill, Swaledale, BBS Meeting, 8 April 2018.

Blasia pusilla: (65) NY814008 Brockholes Gill, Little Sleddale, T.L. Blockeel, 26 January 2018.

Blepharostoma trichophyllum: (65) SD8896 Lover Gill, near Buttertubs, BBS Meeting, 6 April 2018; (65) SD9198 Ivelet Wood, BBS Meeting, 6 April 2018; (65) SE0094999229 and SE0095299200 on boulders by beck, near Healaugh, D. Dobson, 8 April 2018.

Cephalozia connivens: (63) SE7245315304 on wet peat on baulk, Thorne Moors, T.L. Blockeel, 2 November 2018.

Cladopodiella fluitans: (64) SD8069 deep down under ericaceous shrubs in formerly cut bog, Swarth Moor, Helwith Bridge, T.L. Blockeel, M.P. Wilcox & J. Allinson, 23 June 2018.

Cololejeunea minutissima: (65*) NZ15350066 bark of Sycamore, Calfhall Wood, Hudswell Woods, near Richmond, BBS Meeting, 9 April 2018.

Colura calyptrifolia: (65) SD869918 on a small tree, Hardraw Beck, Wensleydale, S. Pilkington and C. Halpin, BBS Meeting, 7 April 2018. Until the turn of the present century, *Colura* was confined to strongly oceanic parts of Britain and the sole Yorkshire site was in the Ingleton Glens. Recently it has spread widely along the western watershed of the Pennines but there are still very few records on the eastern side.

Fossombronia wondraczekii: (63) SK2390 exposed ground on bank of inflow stream of Dale Dike Reservoir, T.L. Blockeel & A.J. Hodgson, 28 August 2018.

Kurzia pauciflora: (62) SE85219751 adjacent to open-water bog pool in deeper peat of valley mire, and SE85199743 in flush with *Erica*, *Drosera* and some *Molinia*, Fen Bog NR, S.J. Heathcote, 7 May 2018.

Lophocolea semiteres: (63) SE7221515534 old tree stump on edge of canal, Southern Canals, Thorne Moor, S.J. Heathcote, 2 November 2018; (65*) SD91039908 on well-trampled track through woodland, Ivelet Wood, Muker, A McLay, BBS Meeting, 6 April 2018. An introduced liverwort which turns up at random sites and is gradually becoming more frequent.

Lophozia sudetica: (65) NZ0102 Slei Gill, Arkengarthdale, BBS Meeting, 8 April 2018.

***Moerckia flotoviana* s.str.**: (64) SD80656940 on wet base-rich ground in fen at edge of raised bog with run-off from nearby quarry embankment, Swarth Moor, Helwith Bridge, T.L. Blockeel, M.P. Wilcox & J. Allinson, 23 June 2018. This seems to be the first record of this rare liverwort in VC64 since the 1960s.

Plagiochila britannica: (65) SE0094399231 on boulders by beck near Healaugh, D. Dobson, 8 April 2018; (65) SD8896 sloping limestone rock, Lover Gill, near Buttertubs, BBS Meeting, 6 April 2018.

Porella arboris-vitae: (65) SD910986 Ivelet Wood, BBS Meeting, 6 April 2018; (65) SD9598 Gunnerside Gill, BBS Meeting, 5 April 2018; (65) NZ0102 Slei Gill, Arkengarthdale, BBS Meeting, 8 April 2018; (65) NZ1401 Whitcliffe Wood, near Richmond, BBS Meeting, 9 April 2018.

Radula lindenbergiana: (65) NY81440084 on wet gritstone rocks, Brockholes Gill, Little Sleddale, T.L. Blockeel, 26 January 2018. The only previous records for VC65 (and indeed Yorkshire) are from Cautley Crag in 1969 and 1970.

Riccardia palmata: (65) NZ1401 Whitcliffe Wood, near Richmond, BBS Meeting, 9 April 2018; (65) NZ1500 Calfhall Wood, Hudswell Woods, near Richmond, BBS Meeting, 9 April 2018; (65) NY80 Keld & Kisdon Force, BBS Meeting, 7 April 2018.

Riccia cavernosa: (63) SK2691 on exposed bed of Damflask Reservoir, T.L. Blockeel & A.J. Hodgson, 28 August 2018.

Riccia huebeneriana: (63*) SK236908 abundant on exposed bed of Dale Dike Reservoir, T.L. Blockeel & A.J. Hodgson, 28 August 2018.

Trichocolea tomentella: (65) NY80590094 in weakly-enriched soak in area of flushes, head of Brockholes Gill, below High Seat, T.L. Blockeel, 26 January 2018. At 640m altitude, this record is the highest localised occurrence for this distinctive liverwort in Britain.

Aloina aloides: (63) SE612200 open ground and sandy mounds, and SE61181996 on south-facing

sandy cliffs, in old sand quarry, Pollington sand quarry, S.J. Heathcote, 9 February 2018. This colonist of bare soil is more usually found on calcareous substrates.

Amblystegium confervoides: (65*) NZ14270179 and NZ14260178 on small stones on the ground, Whitcliffe Wood, near Richmond, J.J. Graham, BBS Meeting, 9 April 2018.

Anomodon longifolius: (65*) NZ142017 among and on sides of limestone boulders, and NZ1418701823 sparsely in angle at juncture of two limestone boulders, Whitcliffe Wood, near Richmond, M. Stribley and T.L. Blockeel, BBS Meeting, 9 and 11 April 2018. Five separate patches of this rare moss were found at Whitcliffe, two of them very small.

Antitrichia curtipendula: (65) SD934947 Oxnop Scar, BBS Meeting, 7 April 2018.

Bryum knowltonii: (65*) SE27698089 among stones at margin of lake in old gravel/sand pit, Nosterfield NR, T.L. Blockeel & YNU, 13 October 2018.

Bryum moravicum: (65) NZ0416 epiphyte, Deepdale, near Barnard Castle, BBS Meeting, 10 April 2018.

Calliergon giganteum: (64) SD8069 edge of pool with some base enrichment at margin of bog, Swarth Moor, Helwith Bridge, T.L. Blockeel, M.P. Wilcox & J. Allinson, 23 June 2018.

Calliergonella lindbergii: (65) SD99 Gunnerside, Winterings, BBS Meeting, 5 April 2018; (65) SD9098 Muker, BBS Meeting, 6 April 2018; (65) SD9198 Ivelet Wood, BBS Meeting, 6 April 2018.

Dicranella subulata: (65) NY98710278 soily bank at edge of path in old mine workings, Hungry Hushes, Arkengarthdale, BBS Meeting, 8 April 2018.

Discelium nudum: (63) SK2390 exposed ground by and near inflow stream of Dale Dike Reservoir, T.L. Blockeel & A.J. Hodgson, 28 August 2018.

Ditrichum plumbicola: (65) NZ01710290 Slei Gill, Arkengarthdale, BBS Meeting, 8 April 2018. This rare moss is tolerant of heavy metals and is known only from old lead mines. It was first found in Swaledale in 2009, and Slei Gill is a new locality.

Encalypta pilifera: (65*) NY900008 small limestone cliffs in woodland, Keld & Kisdon Force, BBS Meeting, 7 April 2018; (65) SD9598 limestone rock ledge, Gunnerside Gill, BBS Meeting, 5 April 2018.

Fissidens gracilifolius: (65*) NZ163007 limestone crags, set back from river, Calfhall Wood, Hudswell Woods, near Richmond, E.M. Kungu, BBS Meeting, 9 April 2018. There are very few records of this small moss in VC65, and it is probably under-recorded.

Fissidens incurvus: (65*) NZ1500 Calfhall Wood, Hudswell Woods, near Richmond, C.D. Preston, BBS Meeting, 9 April 2018. This *Fissidens* is also surprisingly rare in VC65, though frequent in many other parts of England.

Homalothecium lutescens: (63) SE613199 rabbit-grazed grassland, old sand quarry, Pollington sand quarry, S.J. Heathcote, 9 February 2018.

Homomallium incurvatum: (65) NZ1415101825 on stone on the ground, Whitcliffe Wood, near Richmond, BBS Meeting, 4 and 9 April 2018. The population of this rare moss at Whitcliffe seems to be strong and stable. It is currently the only known site extant in Yorkshire.

Leucodon sciuroides: (65) SD870913 on a wall, Simonstone, near Hawes, Wensleydale, BBS Meeting, 7 April 2018; (65) SD9598 on a wall, Gunnerside Gill, BBS Meeting, 5 April 2018; (65) NZ1301 Whitcliffe Scar, near Richmond, BBS Meeting, 9 April 2018; (65) SD9395 Oxnop Scar and Oxnop Gill, BBS Meeting, 7 April 2018.

Microbryum curvicollum: (64) SE4601830025 in small area of disturbed ground on bank, Ledsham Bank NR, S.J. Heathcote, 30 January 2018.

Microbryum rectum: (64) SE46352962 stubble field, Ledsham farmland, S.J. Heathcote, 30 January 2018.

Orthotrichum speciosum: (63) SK262918 on *Acer* sp. in village, Smithy Bridge, Low Bradfield, T.L. Blockeel & A.J. Hodgson, 28 August 2018. Second record for the vice-county. Unlike many other *Orthotrichum* species, *O. speciosum* has increased very slowly following reductions

in SO_2 pollution. It was always rare in Britain, elsewhere favouring territories with more continental or Mediterranean climates.

Orthotrichum striatum: (63) SK262918 on *Acer* sp. in village, Smithy Bridge, Low Bradfield, T.L. Blockeel & A.J. Hodgson, 28 August 2018.

Physcomitrium sphaericum: (63) SK2691 on exposed bed of Damflask Reservoir, T.L. Blockeel & A.J. Hodgson, 28 August 2018. Damflask is a known site for this rare moss that is almost confined to reservoir margins. It is favoured by drought years, when large expanses of bare mud are exposed.

Plagiomnium ellipticum: (64) SD8069 wet woodland, Swarth Moor, Helwith Bridge, T.L. Blockeel, M.P. Wilcox & J. Allinson, 23 June 2018; (65) NY80470100 in area of flushes, head of Brockholes Gill, below High Seat, T.L. Blockeel, 26 January 2018.

Plasteurhynchium striatulum: (65*) NZ1428101840 on south-facing limestone crag shaded by yew, Whitcliffe Wood, near Richmond, T.L. Blockeel, 4 April 2018.

Pogonatum urnigerum: (63) SE6128420043 on west-facing sandy cliff, small population c.3m^2 of around 50 individuals, old sand quarry, Pollington sand quarry, S.J. Heathcote, 9 February 2018. An unusual lowland occurrence of this moss, which is more characteristic of upland regions.

Pohlia annotina: (61) TA42011477 Growing with *Brachythecium* on otherwise bare sand under Sea Buckthorn scrub, Spurn Point, S.J. Heathcote, 18 November 2018.

Pohlia camptotrachela: (63) SK2390 on exposed bed of Dale Dike Reservoir, T.L. Blockeel & A.J. Hodgson, 28 August 2018; (64) SD7754 Lower Knotts NR, G. Haycock & M.P. Wilcox, 20 October 2018.

Pterogonium gracile: (65) NZ13110193, NZ13070194, NZ12970192 on boulders in open grassland, Whitcliffe Scar, near Richmond, BBS Meeting, 9 April 2018.

Racomitrium sudeticum: (65) NY81000084 Brockholes Gill, Little Sleddale, T.L. Blockeel, 26 January 2018; (65) SD875961 on gritstone boulder, Cliff Beck, near Buttertubs, BBS Meeting, 5 April 2018.

Rhizomnium pseudopunctatum: (65) NY805009 in area of flushes, head of Brockholes Gill, below High Seat, T.L. Blockeel, 26 January 2018.

Rhodobryum roseum: (65) NY80 Keld & Kisdon Force, BBS Meeting, 7 April 2018; (65) NY9700 Old Gang and Mill Gill, Swaledale, BBS Meeting, 8 April 2018; (65) NZ0179902852 Slei Gill, Arkengarthdale, BBS Meeting, 8 April 2018; (65) NZ1301 Whitcliffe Scar, near Richmond, BBS Meeting, 9 April 2018. This moss is in long-term decline from the loss of unimproved grassland, a favoured habitat. These recent records from Swaledale are therefore very pleasing.

Rhytidium rugosum: (65) SD937950, SD937951 Oxnop Scar and Oxnop Gill, BBS Meeting, 7 April 2018. This is the only known site for *Rhytidium* in Swaledale, but it is plentiful there.

Schistidium robustum: (65) SD8896 limestone boulders, and SD878963 on stone in area of mine spoil, Lover Gill, near Buttertubs, BBS Meeting, 6 April 2018.

Schistidium trichodon: (65) NY97160072 Old Gang and Mill Gill, Swaledale, BBS Meeting, 8 April 2018; (65) SD87059603 on limestone rock in scree, Cliff Beck and Lover Gill, near Buttertubs, BBS Meeting, 5 April 2018. A rare moss of upland limestones, in England known only from a few Pennine sites.

Scorpidium cossonii: (64) SD806693 on wet base-rich ground in fen at edge of raised bog with run-off from nearby quarry embankment, Swarth Moor, Helwith Bridge, T.L. Blockeel, M.P. Wilcox & J. Allinson, 23 June 2018.

Sphagnum teres: (65) NY805009 in area of flushes, head of Brockholes Gill, below High Seat, T.L. Blockeel, 26 January 2018.

Splachnum sphaericum: (65) SD9394 Oxnop Common, BBS Meeting, 7 April 2018; (65) SD8695 Buttertubs Pass, BBS Meeting, 6 April 2018; (65) NY8501 Birkdale Tarn, upper Swaledale, BBS Meeting, 7 April 2018. This moss of animal dung is dispersed by insects. It has disappeared or declined in some areas, apparently because of the use of endectocide drugs to control parasites in domestic stock.

Tetraplodon mnioides: (65) NY9800 Old Gang and Mill Gill, Swaledale, BBS Meeting, 8 April 2018; (65) NY9601 Hard Level Gill, Swaledale, BBS Meeting, 8 April 2018; (65) NY9700 on bone, Old Gang and Mill Gill, Swaledale, BBS Meeting, 8 April 2018. A distinctive moss colonising animal bones and remains.

Tortula modica: (65) NZ1301 Whitcliffe Scar, near Richmond, BBS Meeting, 9 April 2018.

***Ulota crispa* s.str.:** (64*) SD7754 epiphyte, Lower Knotts, Tosside, M.P. Wilcox, 20 October 2018.

Weissia longifolia* var. *longifolia: (65*) NZ13870187 bare soil in turf on bank, and NZ13780188 old ant-hill, Whitcliffe Scar, near Richmond, T.L. Blockeel & C. Halpin, BBS Meeting, 9 April 2018.

Weissia rutilans: (65*) SD87469604 wet soil on open bank of gill, Cliff Beck and Lover Gill, near Buttertubs, BBS Meeting, 5 April 2018.

Thanks are due to all the contributors of records.

References

Blockeel, T.L. (2018) BBS spring meeting in Swaledale, April 2018. *Field Bryology* 120: 62-75.

Hill, M.O., Blackstock, T.H., Long, D.G. & Rothero, G.P. (2008) *A checklist and census catalogue of British and Irish bryophytes, updated 2008.* British Bryological Society: Middlewich.

Book Review

Canals, Plants and People: a Yorkshire Perspective by **Ray Goulder** (2019). PLACE, York St. John University. 220pp. ISBN: 9781906604653. £10.50 + £3.00 p&p from PLACE, York St John University, Lord Mayor's Walk, York YO31 7EX.

As an ecologist who started their fieldwork career surveying the ditches and drains of the Hatfield Chase (and consequently developing a particular interest in the botany of wetland and aquatic habitats), being asked to write this review was a bit of a 'busman's holiday'.

Canals, Plants and People: a Yorkshire Perspective admirably lives up to its title. The book has the rigour of scientific research but still manages to present an account of recent survey work, background supporting research and observations (including references to source material) in a way that is readable by a non-specialist audience. The publication as a stand-alone book has also allowed the author to offer more personal opinions (supported by the fieldwork and research) which might otherwise be undeservedly termed merely 'anecdotal' observations. The book describes the realities of canal environments, which can range from the delightful to some rather grim urban sites but provides evidence that plants don't discriminate based on appearances.

Chapter 2 provides a snapshot of plant diversity and distribution that will be an important reference to ecologists in the future. The sampling technique using survey sections defined by recognisable features (bridges, locks etc.) rather than relying purely on measured lengths will make it easier to replicate the survey methodology in future years. The familiar problems, pitfalls and dilemmas encountered during survey of aquatic environments are described. Not least, how the distinctly different submerged and emergent growth forms of the same species (such as arrowhead *Sagittaria sagittifolia*) should be classified on the rather arbitrary spectrum of submerged and emergent species, or exactly how you classify a slippery customer such as amphibious bistort *Persicaria amphibia* when it can grow as a floating leaved plant in deep water, an emergent in the water margins and as a creeping herb in dry grassland. The text also includes useful observations on life stages, growth habitats and variable appearances that aquatic plants can exhibit when growing at different depths, all of which would be useful to those wishing to identify and record aquatic plants.

The author's long-term interest in the canal environment means that he is able to share his knowledge of a wide range of factors which influence the vegetation of the waterways. Topics covered include: the effects of original canal construction methods (and subsequent repair techniques), levels of boating usage, neglect, restoration, maintenance of physical structures and vegetation management regimes (both within the aquatic zones and on the adjacent terrestrial towpaths and margins). The wetland environments of the landscapes through which the canals were originally constructed are also considered and cited as a possible explanation for particularly diverse floras in certain waterways, such as the Leven Canal, a site which has been designated as a Site of Special Scientific Interest for its wetland plant assemblage. The habitat preferences of vulnerable plants are given specific analysis. The problems and, dare one say it, even the possible benefits presented by alien plants or plants which occur outside their natural range are also covered. The influence of water quality is touched upon, particularly in terms of pH and turbidity but there probably is still scope for additional work on more pernicious chronic influences such as herbicide run off and chemical contamination, some of which is likely to be a legacy of heavy industry. The ability of wetland plants to spread via various vegetative methods of propagation and dispersal are described when offering explanations of the varying diversity and abundances of different species found in the canals across Yorkshire. The association between the recent appearance of some previously unrecorded species and the use of pre-planted coir rolls is also illustrated by the survey work described in the book.

All the chapters are well illustrated by photographs of habitats, individual species and canal environments. These help to highlight points made in the text and also do help to break up some of the more factual 'data-heavy' sections of text. I did feel that some of the written figures and comparisons of plant abundance between different canals might have benefited by some form of visual or graphical representation. Detailed survey results are all included as tables in the Appendices. Each chapter ends with a useful summary paragraph of the main conclusions.

The book's final chapters discuss the importance of Yorkshire's canals almost as linear water gardens that provide a very wide range of people with enjoyable and accessible contact with aquatic and wetland habitats. There has been an increasing recognition of the importance of canals not just to boat users but as wildlife habitats and places which enhance the quality of life. This publication should be invaluable to the Canal and Rivers Trust (CRT) in providing

factual and detailed information that will support their efforts in seeking future funding for projects and influencing policies at National level which will help to ensure that the flora of canals is conserved in the future.

The CRT is very lucky to have Ray's expertise and advocacy available to promote the waterways of Yorkshire.

LH

YNU Calendar

Events for the rest of 2019 are shown below. Up-to-date information and further details can be found at www.ynu.org.uk/events, and the YNU Membership Card.

Sep	1	Marine and Coastal Section meeting at South Bay, Scarborough, TA049868. Meet at 10.00 at the car park off Sea Cliff Road.
	7	Conchological Section meeting to Marrick Park VC65. Meet in Marrick village at SE078982 at 11.00.
	25	Basic Field Skills Day for University of Leeds MSc students. St. Chad's Parish Centre, Headingley, Leeds.
	28	Bryological Section meeting to Battersby Crag, VC62. Meet at 10.00 on Green Lane, Ingleby Greenhow, NZ581062.
	28	Marine and Coastal Section meeting at Runswick Bay NZ809159. Meet at 8.30 in the car park (pay).
Oct	5	Conchological Section meeting to Market Weighton, VC61, for Rifle Butts Quarry and Kiplingcotes Nature Reserve. Meet at 11.00 in car park at SE90984309.
	12	YNU Executive meeting in the lounge of St. Chad's Parish Centre, Leeds. 10.30 to 12.30.
	19	Entomological Section AGM in Doncaster Museum and Art Gallery. 11.00 to 4.30.
	27	Marine and Coastal Section meeting at South Landing, Flamborough, TA230695. Meet at 8.30 at the YWT Living Seas Centre (pay & display).
Nov	9	Natural Sciences Forum. Whitby Museum, Pannett Park, Whitby. 11.00 to 12.30.
	9	**YNU Annual General Meeting.** Whitby Museum, Pannett Park, Whitby, from 1.30 to 4.00. The meeting will be hosted by Whitby Naturalists' Club and followed by a Presidential Address entitled "Seaweeds – Cinderellas of the Sea" by **Dr Jane Pottas**. For more information and booking visit www.ynu.org.uk/AGM

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The Naturalist

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- using tabs to tabulate information (please use MS Word table format).
- inserting any figures, graphs or plates into the text; indicate their proposed locations in the text and send them as separate files.

Good quality, high resolution images are very welcome and should be sent as .jpg files, with a separate MS Word file containing the caption and name of the person to whom the image should be attributed.

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